CHAPTER 4

ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This chapter of the environmental impact statement (EIS) provides an analysis of the potential environmental consequences that would result from implementation of the Desolation Flats Natural Gas Development project and/or alternatives, including the project components (access roads, drill sites, well drilling, completion and production operations, and reclamation). Mitigation measures and BLM and agency required procedures on public lands that would avoid or reduce impacts have been included in the Proposed Action as described in Chapter 2. The following impact assessment takes these measures into consideration. Additional opportunities to mitigate impacts beyond the measures proposed in Chapter 2 for some resource disciplines are presented in this chapter under Additional Mitigation Measures.

The DFPA Operators anticipate that drilling would typically occur at 2 to 4 wells per section where hydrocarbons are encountered. Development would likely occur sporadically and not be uniformly spaced throughout the DFPA. The Operators anticipate that future development in the DFPA would likely be concentrated within or near existing fields rather than in outlying areas where development currently does not exist. This assessment analyzes the impacts of drilling up to 2 to 4 wells per section, with drilling not uniformly spaced throughout the DFPA.

As noted in Chapter 1 of the DEIS, the Mulligan Draw Field and the Dripping Rock Field are located within the DFPA. An EIS was completed in September 1992 and provided an analysis of a planned natural gas production project on public lands located within the Mulligan Draw Field. The ROD authorized Celsius Energy Company and other operators to drill and develop a maximum of 45 wells on 640-acre spacing to develop the natural gas reserves in the Mulligan Draw Field area. The Dripping Rock Unit/Cedar Breaks EA was completed in April 1985 and also provided an analysis of a planned natural gas production project on public lands located within the DFPA. The DR authorized operators to drill and develop a maximum of 58 wells on 640-acre spacing. The DFPA Operator's are proposing to increase the well density above the one well per section authorized in the Mulligan Draw ROD and the Dripping Rock Unit/Cedar Breaks DR. However, within the 24-section segment of the MVMA which is located within the DFPA, Operators propose to drill only 13 wells.

An environmental impact or consequence is defined as a modification or change in the existing environment brought about by the proposed action or alternatives to the proposed action. Impacts can be direct or indirect in nature, and can be permanent (long-term) or temporary (short-term). Impacts can vary in degree ranging from only a slight discernable change to a drastic change in the environment. Short-term impacts are impacts that occur during and immediately after well pad construction, drilling, testing, and production and last from two to five years. For purposes of this EIS, short-term impacts are defined as lasting five years or less. Long-term impacts are impacts imposed by construction and operations that remain longer than five years or extend for the life of the project or beyond.

The description of the environmental consequences for each resource section in this chapter includes the following subsections:

Introduction - A description of the type and range of potential impacts that could occur as a result

of implementation of the alternatives.

Impact Significance Criteria - A narrative of management objectives for the resource area and the threshold or magnitude at which an impact would be considered significant, thus warranting special attention such as special mitigation. These criteria are based on government regulatory standards, available scientific documentation, previously prepared environmental documents, and the professional judgement of resource specialists.

Direct and Indirect Impacts - An area-specific and site-specific impact assessment relative to the natural gas production alternatives. This section indicates which impacts are significant relative to the impact significance criteria.

Impacts Summary - A narrative comparison of direct and indirect impacts that would occur under each alternative and between alternatives.

Additional Mitigation Measures - Additional mitigation measures that could be applied to avoid or reduce impacts. Where additional mitigation measures have been proposed, the Residual Impacts section includes a description of how the added mitigation measures would further reduce the impacts of the alternative. Where no additional mitigation measures are proposed, the impacts would remain as described under the Direct and Indirect Impacts. Mitigation items specified in the Additional Mitigation Measures are *assumed to be* applicable to impacts on all lands, regardless of ownership. However, the Operators will coordinate with private land owners to determine which measures would be applied, to what degree, and where. The measures identified under this section would be considered for application to all BLM-administered lands.

Residual Impacts - A description of how the Additional Mitigation Measures would reduce the impacts of the Proposed Action. This section is included to provide the reader and the authorized officer with sufficient information to determine whether any, or all, of the additional mitigation measures should be carried into the Record of Decision.

Cumulative Impacts - A description of impacts likely to occur due to this project in combination with other on-going and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable future actions or RFFA's). Cumulative impacts associated with the proposed action and alternatives are summarized in detail in Chapter 5 of this EIS.

The following impact assessment assumes all applicable standards, procedures, and mitigation measures would be applied over all lands. Mitigation cannot be required by the BLM on private land with private minerals. The set of final measures applied to non-federal lands would be determined during the permitting process with WOGCC.

CHAPTER 4: ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.1 GEOLOGY/MINERAL RESOURCES/PALEONTOLOGY

4.1.1 Introduction

4.1.1.1 Geology

Impacts could occur to the geologic environment due to project implementation and operation (e.g., alteration of existing local topography, initiation of mass movements including landslides, acceleration of erosion). Site specific dirt work done while constructing well pads and ancillary facilities could result in minor changes to the geologic environment including disturbance of soils and underlying parent material.

4.1.1.2 Mineral Resources

Petroleum reserves would be considerably depleted by implementation of the proposed action or alternatives to the proposed action within the DFPA. The proposed project would allow recovery of federal natural gas resources, and therefore, loss of reserves in the ground, as per 43CFR 3162(a), and generate private and public revenues if drilling leads to gas discovery and development.

If successful, exploratory drilling would define gas field development objectives. Good reservoir rock is not uniformly distributed within the DFPA. Therefore, development wells would most likely be drilled along productive trends or pockets between large intervening areas that are nonproductive and have little or no development potential.

Sand, gravel, and clinker may increase in demand for building materials for roads, well pads and other ancillary facilities, which could lead to local depletion of these construction resources. Additional construction grade material sources would likely be used in addition to those identified locally. Although there is the potential for mining uranium within the DFPA, no development is expected in the near future. The potential for other mineral development, including locatables (gold, other minerals) or coal is low.

4.1.1.3 Paleontology

Construction of well pads, access roads, production facilities and excavation of pipeline trenches could result in the exposure and possible destruction of fossil resources, resulting in an associated loss of scientific information. Construction-related disturbances could result in new fossil resources being discovered, properly recovered and catalogued into the collections of a museum repository, making them available for study and scientific evaluation. The magnitude of impacts associated with the destruction of fossil resources would be reduced by the implementation of paleontologic resource mitigation measures described in Section 4.1.5.3, which are based on findings in the paleontologic report (EVG 2001) prepared for the project and submitted to the BLM Rawlins, Rock Springs, and State offices.

4.1.2 Impact Significance Criteria

4.1.2.1 Geology

Impacts to geology could be significant if project implementation results in mass movement (including landsliding), subsidence, flooding, or increased erosion.

4.1.2.2 Minerals

Depletion of petroleum reserves from subsurface reservoirs resulting from oil and gas development may be considered a significant impact. However, drilling and producing petroleum reserves is allowed by federal and state agencies and private landowners. Drilling operations as described in Section 2.5.2.3 and as regulated by the BLM on federal lands, and the WOGCC on state and private lands would result in systematic development of petroleum reserves if exploratory drilling is successful.

If successful, exploratory drilling would lead to extensive oil and gas development and local depletion of construction materials (sand, gravel, and clinker), due to increased demands for surfacing material for roads and other facilities.

4.1.2.3 Paleontology

Impacts to paleontologic resources would be significant if scientifically important fossils are damaged or destroyed as a result of project implementation. Paleontologic analysis (EVG 2001) documented the presence of sedimentary formations of Early Tertiary age at the surface of the project area. These formations are known to produce scientifically important vertebrate fossils or have high potential to contain such fossils. These formations include the Washakie, Green River, and Wasatch. Vertebrate fossil localities in the Washakie Formation within or adjacent to the project area have been documented by the Field Museum (Chicago), American Museum of Natural History (New York), Carnegie Museum (Pittsburgh), and Geology Department of the University of Wyoming (Laramie). Although no institutional localities were recorded in the Browns Park, Wasatch (Cathedral Bluffs Member) and Green River (Laney and Godiva Rim members) formations on the project area, these formations and members are known to yield scientifically important fossils elsewhere in Wyoming.

4.1.3 Direct and Indirect Impacts

4.1.3.1 Geology

Direct impacts to geology as a result of project implementation would include damage to the surface environment such as alteration of existing local topography that causes mass movements including landslides, results in flooding, or accelerated erosion. The Proposed Action, Alternative A, or Alternative B would not contribute to increased risks of earthquakes, subsidence, or flooding. Earthquake-induced ground shaking could result in damage to above ground structures although the likelihood of earthquakes is low as indicated by the absence of recorded epicenters in the area. Buried structures would only be affected if shaking induces ground failure or subsurface rupture.

4.1.3.2 Minerals

Inventory of mineral resources in the DFPA revealed no major mineral resources that would be impacted by implementation of the project other than petroleum reserves. Successful field development would result in petroleum production and depletion if permitted by federal and state agencies, which is therefore not considered an adverse impact.

Successful implementation of the Proposed Action would substantially increase natural gas production in Sweetwater and Carbon counties. Under the assumptions used for this assessment,

annual gas production would total 16 million MCF in 2003, increase to 50.5 million MCF in 2021, and then gradually decrease to about 10 million MCF in 2041. By comparison, Sweetwater and Carbon County natural gas production in 1999 totaled 224 million MCF and 80 million MCF respectively. At the volumes assumed for this assessment, over 1.1 trillion cubic feet of natural gas would be produced over the 40 year production cycle.

Additionally, each Desolation Flats well is estimated to produce an annual average of 1,000 barrels of condensate. Condensate volumes are projected to increase from a 2003 total of about 32,600 barrels to a peak of about 101,000 barrels in 2021 and decrease to about 21,000 barrels in 2041. Over the 40 years, condensate volumes would total an estimated 2.26 million barrels.

Under Alternative A the increased number of wells drilled would result in greater gas and condensate production if a greater number of wells are completed successfully. Under the No Action Alternative, the Proposed Action would not be implemented and further drilling would be allowed on federal lands to the extent that it would be within the scope of existing environmental analyses (i.e. Mulligan Draw and Dripping Rock decisions) and individual APD's that could be approved on a case-by-case basis. In terms of magnitude, such impacts would likely be substantially less than for the Proposed Action.

Construction grade materials are likely to be used from local sources for surfacing materials for oil and gas facilities. If development is extensive, known accumulations of local materials may become depleted and additional sources outside of or within the DFPA would need to be identified and used. The magnitude of impacts depends on the number of roads, well pads, and other facilities built under each alternative.

4.1.3.3 Paleontology

Direct impacts to fossils would include damage or destruction of important fossils during construction, with subsequent loss of scientific information. Adverse indirect impacts would include fossil damage or destruction by accelerated erosion due to surface disturbance. In addition, improved access and increased visibility may result in unauthorized fossil collection or vandalism.

Excavation could reveal fossils of scientific significance that would otherwise have remained buried and unavailable for scientific study. Newly discovered fossils would be available for future scientific study if they are properly collected and catalogued into the collections of a museum repository along with associated geologic data. In this way significant positive consequences, including the unanticipated discovery of previously unknown scientifically significant fossils, could result.

The Proposed Action, Alternative A, and No Action Alternative could result in direct and indirect impacts to fossil resources caused by surface disturbance, especially if disturbances affect geological formations known to have a high potential to contain fossils of scientific importance (BLM Paleontology Classes 3, 4, and 5). Increased surface disturbance under Alternative A, could result in potentially more impact (both adverse and beneficial) to fossil resources over that of the Proposed Action, dependent upon where individual wells and associated facilities are sited and where ROW actions occur. Under the No Action Alternative, the Proposed Action would not be implemented and further drilling would be allowed on federal lands to the extent that it would be within the scope of existing environmental analyses (i.e. Mulligan Draw and Dripping Rock decisions) and individual APD's that would be approved on a case-by-case basis. In terms of magnitude, such impacts would likely be substantially less than for the Proposed Action.

Table 4-1. Geologic Deposits and Level of Field Survey Recommended.

Geologic Deposit	Paleontologic Potential	Field Survey Recommended
Washakie Formation - all members	BLM Class 5	detailed
Browns Park Formation	BLM Class 2	spot check
Green River Formation-Laney and Godiva Rim Members	BLM Class 5	spot check
Wasatch Formation-Cathedral Bluffs Member	BLM Class 5	spot check

4.1.4 Impacts Summary

Implementation of the Proposed Action involves the development of surface and subsurface facilities and as a result has the potential for direct and indirect impacts to geologic, mineral, and fossil resources. The nature of ground disturbance associated with the proposed action, as well as other alternatives is described in Chapter 2. No adverse impacts to the geologic or mineral resources are anticipated under the Proposed Action, Alternative A, or the Alternative B, if mitigation discussed in Section 2.5.2.11.2 is adopted. Application of this mitigation to all lands, private or public, included in the Proposed Action, Alternative A and Alternative B will further reduce potential direct and indirect impacts to these resources.

With the appropriate pre-disturbance surveys/inventories required in high probability occurrence areas for Class 4 and Class 5 areas, as described in Section 4.1.2.3.1, and case-by-case inventories in Classes 1-3, and as required by mitigation measures identified in Section 2.5.2.11.2, the likelihood that significant fossil resources would be damaged or destroyed is low.

4.1.5 Additional Mitigation Measures

4.1.5.1 Geology

Mitigation measures presented in the Soils and Water resources sections would avoid or minimize the potential impacts to the surface geologic environment and lessen the possibility of mass movement, flooding, and therefore, no additional mitigation measures are required.

4.1.5.2 Minerals

No additional mitigation measures that would address petroleum depletion are proposed.

4.1.5.3 Paleontology

With implementation of mitigation measures proposed in Section 2.5.2.11.2 for Paleontology no additional mitigation measures are required.

4.1.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.1.3.

4.2 AIR QUALITY

4.2.1 Introduction

4.2.1.1 Scoping Issues

In recent years, the development of mineral resources throughout Wyoming has heightened the public's awareness of air quality. A number of public comments concerning air quality issues were received during the scoping process and are summarized below.

1. Operators should obtain permits and apply Best Available Control Technology (BACT) to all sources of volatile organic compounds (VOC) and hazardous air pollutants (HAP), including sources with emissions below the control thresholds currently set by WDEQ policy.

2. Additional air quality monitoring stations should be installed near major sources within the project area to ensure compliance with state and National Ambient Air Quality Standards (NAAQS). This monitoring should include both criteria and hazardous air pollutants.

3. Concerns that prescribed burns may affect air quality monitoring results should be addressed.

4. The public and operator employees should be informed of the risks associated with potential exposure to HAP.

5. Concerns with potential cumulative impacts of atmospheric pollution on Class I wilderness areas should be addressed.

6. Options for off-site mitigation to improve overall air quality in southwest Wyoming should be investigated.

7. The Desolation Flats air quality impact analysis should be tiered off of the previous Continental Divide/Wamsutter II, South Baggs and Pinedale Anticline analyses.

4.2.1.2 Assessment Protocol

An Air Quality Assessment Protocol was developed which proposed the methodologies for quantifying potential air quality impacts from the proposed project and surrounding developments. The criteria for evaluating the significance of the potential air quality impacts was also addressed in the protocol. The protocol was prepared with input from the BLM, State of Wyoming, FS, United States EPA Region VIII, environmental groups including the Wyoming Outdoor Council, Powder River Basin Resource Council and Northern Plains Resource Council with the project proponents, thereby ensuring that the assessment methodology was technically sound and acceptable to all parties.

In determining the protocol for this assessment, the consensus was to perform a single impact analysis for Alternative A. As proposed, Alternative A provides for an increased well density and production capacity beyond that described in the Proposed Action. Under Alternative A, 592 gas wells would be developed at 555 locations, with a forecasted success rate of 65 percent resulting in 385 producing wells. The producing wells would be supported with six compressor stations and two gas processing plants. Compression and processing requirements for Alternative A are estimated at 32,000 horsepower. The analysis of Alternative A represents the worst-case scenario. Potential air quality impacts resulting from the Proposed Action and the No Action alternatives would be less than the impacts resulting from the implementation of Alternative A.

4.2.2 Impact Significance Criteria

In order to evaluate potential air quality impacts, a scale of measurement or significance criteria must be defined. For this analysis, potential impacts to air quality are considered to be significant if project related emissions cause or contribute to:

- A violation of Wyoming (WAAQS), Colorado (CAAQS) or national ambient air quality standards (NAAQS); or
- An Exceedance of the PSD increments for Class I or Class II areas; or
- Toxic HAP concentrations that exceed state designated thresholds; or
- A lifetime incremental increase in cancer risk of one additional person in one million assuming the most likely exposure scenario; or
- Visibility impacts to sensitive areas above the designated 0.5 or 1.0) dv (change in deciview) thresholds; or
- Changes in sensitive lake ANC greater than the designated LAC. For sensitive water bodies with existing ANC levels less than 25 : eq/l, the LAC is no greater than 1 : eq/l. A 10 percent change in ANC is considered significant for lakes with existing ANC levels greater than 25 : eq/l.

4.2.3 Direct and Indirect Impacts

Three primary levels of modeling (sub-grid, near-field, and far-field) were used to characterize air quality impacts. Sub-grid modeling was conducted to predict impacts in the immediate vicinity of individual sources (i.e., individual wells and compressor stations) for comparison to state and federal ambient air quality standards and PSD Class II increments. Sub-grid modeling was also utilized to predict hazardous air pollutant concentrations and incremental cancer risks resulting from project related sources. Near-field modeling was conducted to predict impacts within the Desolation Flats project area and 30 miles (50 kilometers) beyond its boundaries. The results of the near-field modeling were compared to state and federal air quality standards and PSD Class II increments. Far-field modeling was used to predict impacts to ambient air quality, PSD Class I increments and Air Quality Related Values (visibility and acid deposition) at eight sensitive areas. Table 4-2 lists the analyzed sensitive areas, the agency responsible for their management, and the average distance from the project area. It should be noted that all comparisons with PSD increments are intended only to evaluate a level of concern and do not represent a regulatory PSD increment consumption analysis. PSD increment consumption analyses are applied to large industrial sources and are solely the responsibility of the State and the Environmental Protection Agency.

Sub-grid modeling was performed using the Industrial Source Complex (ISCST3) model to assess impacts of individual wells and multiple wells in combination with compression stations at distances

of up to 4 kilometers (km) from the source. ISC is a Gaussian model that assumes instantaneous straight line transport of pollutants from the source to the receptor. In general, a 100 meter grid spacing was used for the sub-grid modeling.

Table 4-2. Analyzed Sensitive Areas

Sensitive Area	Managing Agency	Average Distance From Project Area (miles)	Direction From Project Area
Bridger Wilderness (Class I)	US Forest Service	140	NW
Fitzpatrick Wilderness (Class1)	US Forest Service	155	NW
Popo Agie Wilderness (Class II)	US Forest Service	115	NW
Wind River Roadless Area (Class II)	US Forest Service	135	NW
Dinosaur National Monument (Class II)	National Park Service	65	SW
Savage Run Wilderness (Class I)	US Forest Service	85	E
Mount Zirkel Wilderness (Class I)	US Forest Service	75	ESE
Rawah Wilderness (Class I)	US Forest Service	110	ESE

Near-field modeling was performed using the CALPUFF set of models (CALMET, CALPUFF, and CALPOST). The CALPUFF models are Lagrangian puff models that allow for wind meander and long range transport of pollutants. The Near-field modeling was performed for distances out to 50 km from the project area boundary. A 4 km grid spacing was used for the near field modeling.

Far-field modeling was also performed with the CALPUFF set of models for the entire modeling domain of 400 km (north-south) by 500 km (east-west). A four km receptor grid spacing was used throughout the modeling domain (12,500 receptors) supplemented with an additional 401 receptors located at the boundaries and within the eight sensitive areas and an additional twelve receptors located at the sensitive lakes evaluated for acid deposition. Figure 4-1 presents the near- and far-field domains along with the sensitive receptor areas.

Meteorological data used in the ISC model were collected at the South Baggs station in 1995. For CALPUFF, the meteorological input utilized a 1995 meso-scale MM5 simulation as the initial wind field. The MM5 wind field was refined utilizing terrain and land use data along with surface and upper air meteorological data collected at National Weather Service sites in 1995 throughout the region.

In addition to the sub-grid, near-field and far-field analyses, a fourth modeling methodology was used to assess the impacts of vehicles traveling on unpaved support roads. The CALINE4 model was used with hypothetical worst-case meteorology coupled with traffic volumes determined as part of the emissions estimates.

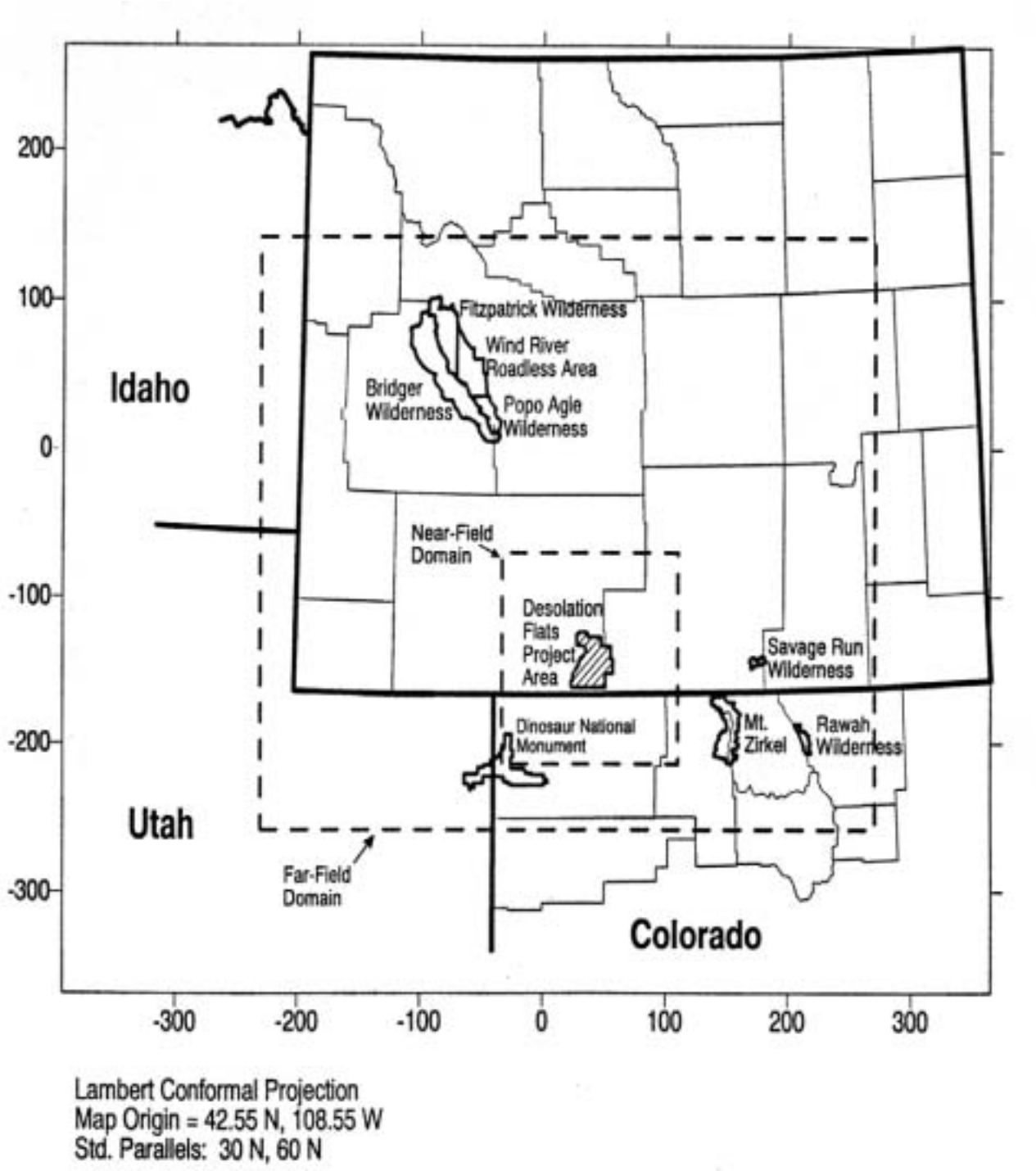


Figure 4-1. Modeling Domains and Sensitive Receptor Areas.

A fifth modeling methodology was used to assess the potential contribution of VOC emissions to regional ozone concentrations. A simplified Reactive Plume Model (RPM II) screening methodology developed by the EPA (Scheffe 1988) was utilized for the analysis. The Scheffe methodology uses the ratio of VOC to NO_X emissions and the magnitude of the VOC emissions to evaluate potential ozone contribution of point sources. The methodology is a commonly used screening method and is considered very conservative.

4.2.3.1 Alternative A

4.2.3.1.1 Emission Inventory for Alternative A Project Related Sources

An air emission inventory was developed for all sources proposed under Alternative A. The inventory estimated emissions for five criteria pollutants; oxides of nitrogen (NO_X), SO_2, CO, particulate matter less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$), and VOC. The inventory also estimated HAP emissions for six compounds including benzene, toluene, ethylbenzene, and total xylenes (collectively called BTEX), normal-hexane(n-hexane), and formaldehyde.

Project related activities evaluated in the emission inventory included:

- construction emissions, including well pad and resource road construction;
- well drilling, completion and testing;
- wind erosion of disturbed areas;
- well production emissions, and
- gas compression and processing.

Specific details of the emission inventory are documented in the Air Quality Technical Report. A summary of the emission inventory follows.

Well Development Emissions

Air emissions result from three sequential well development activities: well pad and resource road construction, well drilling, and well completion. Emissions for both regulated pollutants and HAP were estimated for each activity as applicable.

Well pad and resource road construction consists of the clearing, grading, and construction of the road and well pad. The emissions sources associated with these activities include fugitive dust emissions from travel on unpaved roads, heavy construction operations, and tailpipe emissions from mobile sources used in the construction process. It was assumed that controls for these sources would include watering on the well pad and service roads during well pad and resource road construction to control emissions of particulate matter. The watering control efficiency was assumed to be 50 percent.

Well drilling consists of rigging-up, drilling, and rigging-down. The emissions sources associated with well drilling include fugitive dust emissions from travel on unpaved roads and tailpipe emissions from mobile sources such as heavy duty diesel engine powered trucks and drill rigs used in the drilling process. Particulate matter is assumed to be controlled by watering the unpaved roads, with a control efficiency of 50 percent.

Well completion includes the perforation and stimulation of the producing formations and flow testing. The emission sources associated with well completion include fugitive dust emissions from

travel on unpaved roads, tailpipe emissions from mobile sources and flaring of natural gas for well evaluation. Particulate matter is assumed to be controlled by watering the unpaved roads, with a control efficiency of 50 percent.

Both short-term maximum (hourly) and long-term (annual) emissions were estimated for construction operations. For the calculation of short-term emissions, the consecutive nature of these activities was taken into account. During a one-hour period at any given well, only one of the three development activities; road construction, drilling, or completion, would be taking place. Therefore, short-term emissions were calculated as the single maximum hourly emission rate from each of the three development activities. Long-term well development emissions were estimated on an annual basis assuming a development rate of 45 wells per year. Typically, each constructed well would undergo all three development activities; construction, drilling, and completion, over the course of a year. Therefore, long-term emissions were calculated as the sum of the emissions from the three development activities.

Well Production Emissions

Emissions to the atmosphere result primarily from three aspects of gas production: three-phase separation, triethylene glycol (TEG) dehydration, and condensate storage. The emissions of both criteria pollutants and HAP were estimated for each process as applicable.

At each well, a natural gas-fired three-phase separator heater, rated at 750,000 BTU per hour, will operate an average of 15 minutes per hour throughout the year. In addition, a glycol regeneration heater, rated at 250,000 BTU per hour, is assumed to operate 15 minutes per hour on average throughout the year. To account for seasonal variation in heater operations, the emissions were weighted for the impact analysis. During the winter months of November through April, the heater emissions were weighted at 172% of the average rate, while the remaining summer months were weighted at 28% of the average emission rate.

VOC and HAP emissions from the glycol dehydration system were estimated using Gas Research Institute's (GRI's) GlyCalc emissions estimation program. Dehydrator still vent emissions are dependent upon the produced gas composition and throughput. For this study, predicted emissions from a typical well were calculated assuming an average production rate of 1.0 MMscf/day. The inlet gas composition was estimated by averaging the gas analyses from three existing wells in the study area. HAP concentrations were conservatively estimated at the maximum concentration observed in the three existing wells. Dehydrator emissions were calculated on an individual well and a total project basis. It was assumed that no controls will be required for dehydrator still vent emissions.

Flashing emissions occur as a result of pressure differentials between the separator and the storage tank. For this study, the flashing of VOC and HAP from a condensate storage tank were estimated utilizing a HYSYM process simulation conducted for a well located near the study area. Individual well flashing emissions were based upon an average condensate production rate of two barrels per day. Since the average rate of condensate production is relatively low, it was assumed that no controls would be required for flashing emissions.

Storage tank working and breathing losses occur as a result of the filling and emptying of the storage tanks and the daily heating and cooling of the condensate which results in thermal expansion. An emission estimation program, Tanks 4.0, was utilized to calculate the storage tank

emissions. For this analysis, the condensate was assumed to have an average Reid vapor pressure of 8.0. Again, an average condensate production rate of two barrels per day was assumed.

Wind Erosion Emissions

Wind erosion emissions were calculated for disturbed areas, such as the well pad and access roads. The wind erosion estimates were calculated based upon meteorological data measured near Baggs, Wyoming in 1995.

Compression Emissions

The emissions resulting from compression operations were calculated for a total of 32,000 horsepower, based upon estimated project requirements of 30,000 horsepower for gas transportation and 2,000 horsepower for gas plant processing. Application of state-regulated BACT was considered in estimating compression emissions. Current control technology can reduce NO_X emissions to between 0.7 and 1.5 grams per horsepower-hour (g/hp-hr). NO_X emissions were quantified at the most typical rate of 1.0 g/hp-hr, while CO and VOC emissions were quantified at 3.0 g/hp-hr and 0.5 g/hp-hr respectively. Hazardous air pollutant emission rates were estimated based on AP-42 emission factors.

Total estimated emissions for Alternative A are summarized in Table 4-3. The estimate assumes 45 wells are constructed each year and 385 wells produce a combined 385 MMscf/day of natural gas and 770 bbls/day of condensate.

Table 4-3. Annual Project Emissions

Air Pollutant	Project Emissions (tons/year)			
	Well Construction and Development [1]	Well Production [2,3]	Gas Compression and Processing[4]	Total Project Emissions
NO_X	721.3	41.5	309.0	1,072
CO	198.7	10.9	927.0	1,137
VOC	26.2	14,755	154.5	14,936
SO_2	12.2	-	-	12.2
PM_{10}	236.2	51.4	6.8	294
$PM_{2.5}$	50.1	22.5	6.8	79
Benzene	-	360.3	0.6	361
Toluene	-	902.7	0.2	903
Ethylbenzene	-	474.5	-	475
Xylenes	-	624.8	0.1	625
n-Hexane	0.1	31.6	-	31.7
Formaldehyde	0.1	0.03	46.3	46.4

[1] Assumes 45 wells are constructed and developed per year

[2] Assumes 385 gas wells are producing 385 MMscf/day and 770 bbls/day of condensate

[3] Well production emissions include wind erosion

[4] Assumes total compression and processing requires 32,000 hp

4.2.3.1.2 Alternative A Sub-grid Impact Analysis

Single Well Sub-grid Analysis

Each phase in the development of a single well; construction, drilling, completion and production, was analyzed individually. Emissions from the well pad and the associated lease road were included in the analysis. The orientation of the lease road was rotated with respect to the prevailing winds in ten degree increments to determine the greatest impact for all potential site configurations. Table 4-4 presents the potential ambient air quality impacts for each development phase of an individual well. The maximum impact for each individual phase of operation was added to the monitored background concentrations and compared to the applicable ambient air quality standards. As presented in Table 4-5 and Figure 4-2, potential impacts for a single well would not cause an exceedance of the state or federal ambient air quality standards. The predicted well development impacts are also below the Class II PSD increments as shown in Table 4-6.

Table 4-4. Ambient Air Quality Impacts Adjacent to a Single Well

Pollutant	Averaging Period	Construction Impact (: g/m^3)	Drilling Impact (: g/m^3)	Completion Impact (: g/m^3)	Production Impact (: g/m^3)	Maximum Impact (: g/m^3)
NO_2	Annual	0.0026	1.92	0.014	0.02	1.92
CO	1-hour	22.83	123.61	438.83	0.22	438.83
CO	8-hour	4.00	59.79	191.64	0.09	191.64
SO_2	3-hour	0.83	5.93	0.012	0	5.93
SO_2	24-hour	0.17	2.29	0.0027	0	2.29
SO_2	Annual	0.00005	0.032	0.00001	0	0.032
PM_{10}	24-hour	23.69	3.48	4.99	0.03	23.69
PM_{10}	Annual	0.0015	0.047	0.012	0.001	0.047
$PM_{2.5}$	24-hour	3.29	2.72	2.05	0.02	3.29
$PM_{2.5}$	Annual	0.00037	0.038	0.002	0.001	0.038

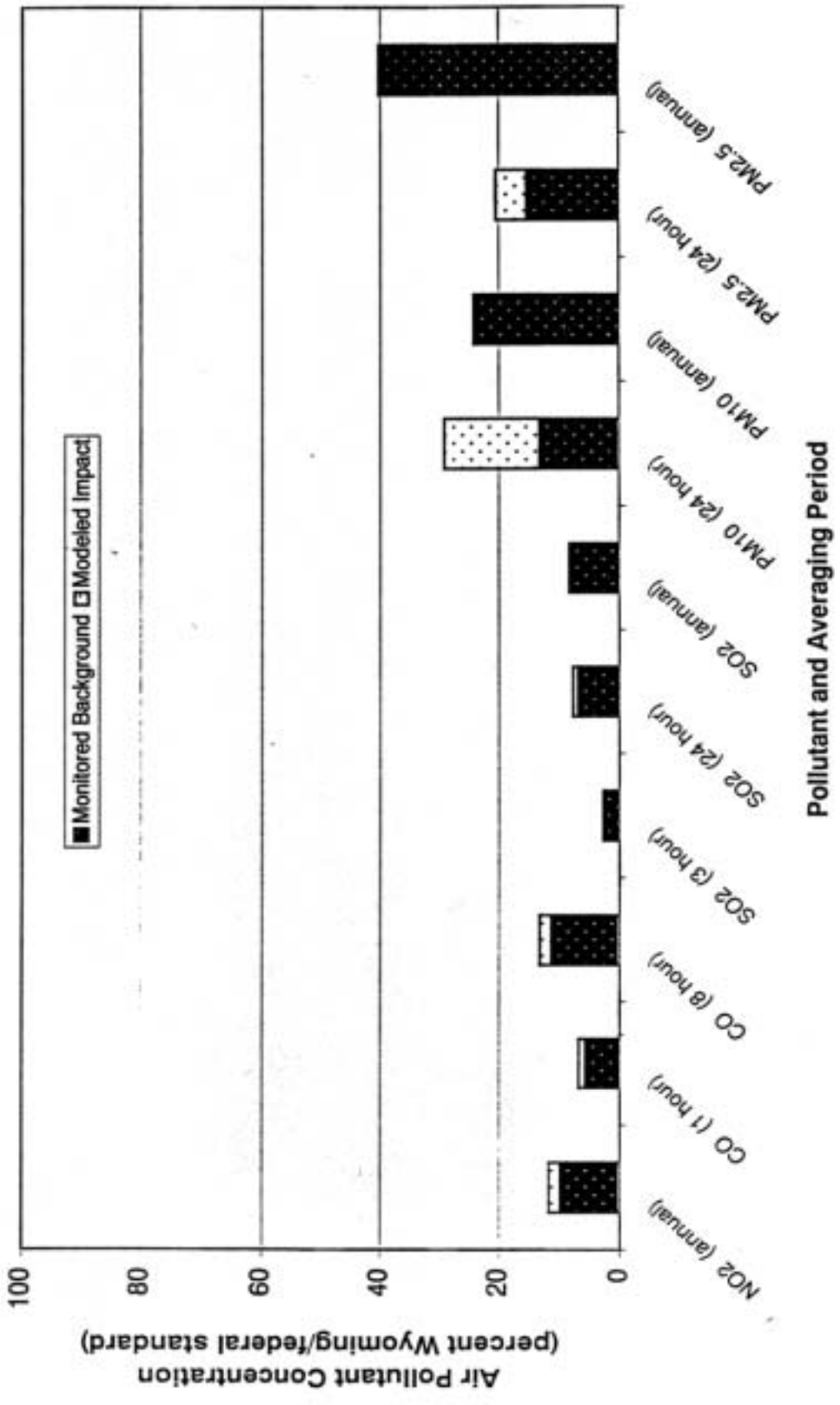


Figure 4-2 Maximum Ambient Air Quality Impacts for an Individual Well

Table 4-5. Maximum Ambient Air Quality Impacts for an Individual Well

Pollutant	Averaging Period	Maximum Single Well Impact (: g/m^3)	Monitored Back-ground Level (: g/m^3)	Maximum Impact Plus Back-ground (: g/m^3)	National Ambient Air Quality Standard (: g/m^3)	Wyoming Ambient Air Quality Standard (: g/m^3)	Colorado Ambient Air Quality Standard (: g/m^3)	Percentage of Most Stringent Ambient Air Quality Standard
NO_2	Annual	1.92	10	11.92	100	100	100	12%
CO	1-hour	438.83	2,299	2,738	40,000	40,000	40,000	7%
CO	8-hour	191.64	1,148	1,340	10,000	10,000	10,000	13%
SO_2	3-hour	5.93	29	34.93	1,300	1,300	700	5%
SO_2	24-hour	2.29	18	20.29	365	260	365	8%
SO_2	Annual	0.032	5	5.032	80	60	80	8%
PM_{10}	24-hour	23.69	20	43.69	150	150	150	29%
PM_{10}	Annual	0.047	12	12.047	50	50	50	24%
$PM_{2.5}$	24-hour	3.29	10	13.29	65	NA	NA	20%
$PM_{2.5}$	Annual	0.038	6	6.038	15	NA	NA	40%

Note: $PM_{2.5}$ background assumed to be one-half of PM_{10} background.

Table 4-6. Individual Well Increment Comparison

Pollutant	Averaging Time	Individual Well Impact (: g/m^3)	PSD Class II Increment (: g/m^3)	Percentage of Class II Increment (: g/m^3)
NO_2	Annual	1.92	25	8%
SO_2	3-hr	5.93	512	1%
SO_2	24-hr	2.29	91	3%
SO_2	Annual	0.032	20	0.2%
PM_{10}	24-hr	23.69	30	79%
PM_{10}	Annual	0.047	17	3%

Gas Plant and Well Field Sub-grid Analysis

A sub-grid analysis was also performed for a typical gas plant and surrounding well field. For the analysis it was assumed that the gas plant would consist of five separate compressor units totaling 6,000 horsepower. It was also assumed that the gas plant was centered in a producing well field with a density of one well every 40 acres. This scenario yields the worst-case impacts for the combined project sources. Tables 4-7 and 4-8 present the combined gas plant and well grid impacts and compares the results to the applicable ambient standards and PSD increments. The ambient standard comparisons are also charted in Figure 4-3. As shown, the predicted impacts are below all applicable ambient standards and increment levels.

Support Road Air Pollutant Sub-grid Analysis

The analysis of emissions generated from vehicle traffic on an unpaved support road indicated that the maximum impact is from fugitive dust. The maximum 24-hour average PM_{10} impact is 23.9 :g/m$^{3.}$ When added to the background concentration of 20 :g/m^3, the combined impact is 43.9 :g/m^3 which is only 29% of the most stringent ambient air quality standard (150 :g/m^3).

Table 4-7. Gas Plant and Well Field Impact

Pollutant	Averaging Period	Gas Plant and Well Field Impact (:g/m^3)	Monitored Back-ground Level (:g/m^3)	Maximum Impact Plus Back-ground (:g/m^3)	National Ambient Air Quality Standard (:g/m^3)	Wyoming Ambient Air Quality Standard (:g/m^3)	Colorado Ambient Air Quality Standard (:g/m^3)	Percentage of Most Stringent Ambient Air Quality Standard
NO_2	Annual	4.17	10	14.17	100	100	100	14%
CO	1-hour	168.39	2,299	2,467	40,000	40,000	40,000	6%
CO	8-hour	83.69	1,148	1,232	10,000	10,000	10,000	12%
SO_2	3-hour	0	29	29	1,300	1,300	700	4%
SO_2	24-hour	0	18	18	365	260	365	7%
SO_2	Annual	0	5	5	80	60	80	8%
PM_{10}	24-hour	7.31	20	27.31	150	150	150	18%
PM_{10}	Annual	1.69	12	13.69	50	50	50	27%
$PM_{2.5}$	24-hour	2.58	10	12.58	65	NA	NA	19%
$PM_{2.5}$	Annual	0.71	6	6.71	15	NA	NA	45%

Note: $PM_{2.5}$ background assumed to be one-half of PM_{10} background.

Table 4.8. Gas Plant and Well Field Increment Comparison

Pollutant	Averaging Time	Gas Plant and Well Field Impact (: g/m^3)	PSD Class II Increment (: g/m^3)	Percentage of Class II Increment (: g/m^3)
NO_2	Annual	4.17	25	17%
SO_2	3-hr	0	512	0%
SO_2	24-hr	0	91	0%
SO_2	Annual	0	20	0%
PM_{10}	24-hr	7.31	30	24%
PM_{10}	Annual	1.69	17	10%

Hazardous Air Pollutant Sub-grid Analysis

A HAP analysis was conducted for the worst-case well field and gas plant scenario. The potential short-term (8-hour exposure) and long-term (i.e., chronic, annual) health effects resulting from the emission of the six previously listed toxins were analyzed. Emissions of each of the hazardous air pollutants were analyzed for their direct impact on health (e.g., headaches, irritation of eyes and throat, etc.). In addition, benzene and formaldehyde emissions were analyzed for their carcinogenic effects. The results indicate that the short-term (8-hour) pollutant concentrations for each of the six toxins are below the most stringent acceptable ambient concentration level (AACL) with the exception of benzene (104%). However, potential benzene impacts were far less than the greatest AACL (only 4%). The results are summarized in Table 4-9. Emissions of these six toxins are not expected to cause short-term health impacts. The short-term impacts were assessed at receptors located 100 meters from the well pads and compressor stations. Theoretically, a person could be within 100 meters of a operating well pad for 8 hours. However, wells are not allowed to be constructed within 350 feet (107 meters) of a residence. As the distance from a well to a receptor (e.g., a residence) increases, the impacts decrease. A discussion of the basis for the AACLs is provided in the Air Quality Technical Report.

Benzene and formaldehyde exposure has been associated with potential carcinogenisis. Carcinogenic impacts are assessed by evaluating annual concentrations, and assuming maximum exposure, 24 hours per day, 365 days per year for the lifetime of the project (30 years). This is termed the maximum exposure scenario. A more realistic exposure scenario is based on 64% of an individual's time spent outdoors at full concentration, and 36% of the time spent indoors at one-quarter of the full concentration, for a period of nine years, defined in EPA literature as a realistic estimate of length of residence. This more realistic exposure scenario is termed the most likely exposure.

Annual concentrations were modeled at a distance of 1,320 feet (400 meters) from the well pad or compressor site. The 1,320 foot distance is characteristic of the minimum source-receptor distances observed on federal lands. The results, shown in Table 4-10, indicate that under the most likely exposure scenario, worst-case benzene and formaldehyde impacts are below the

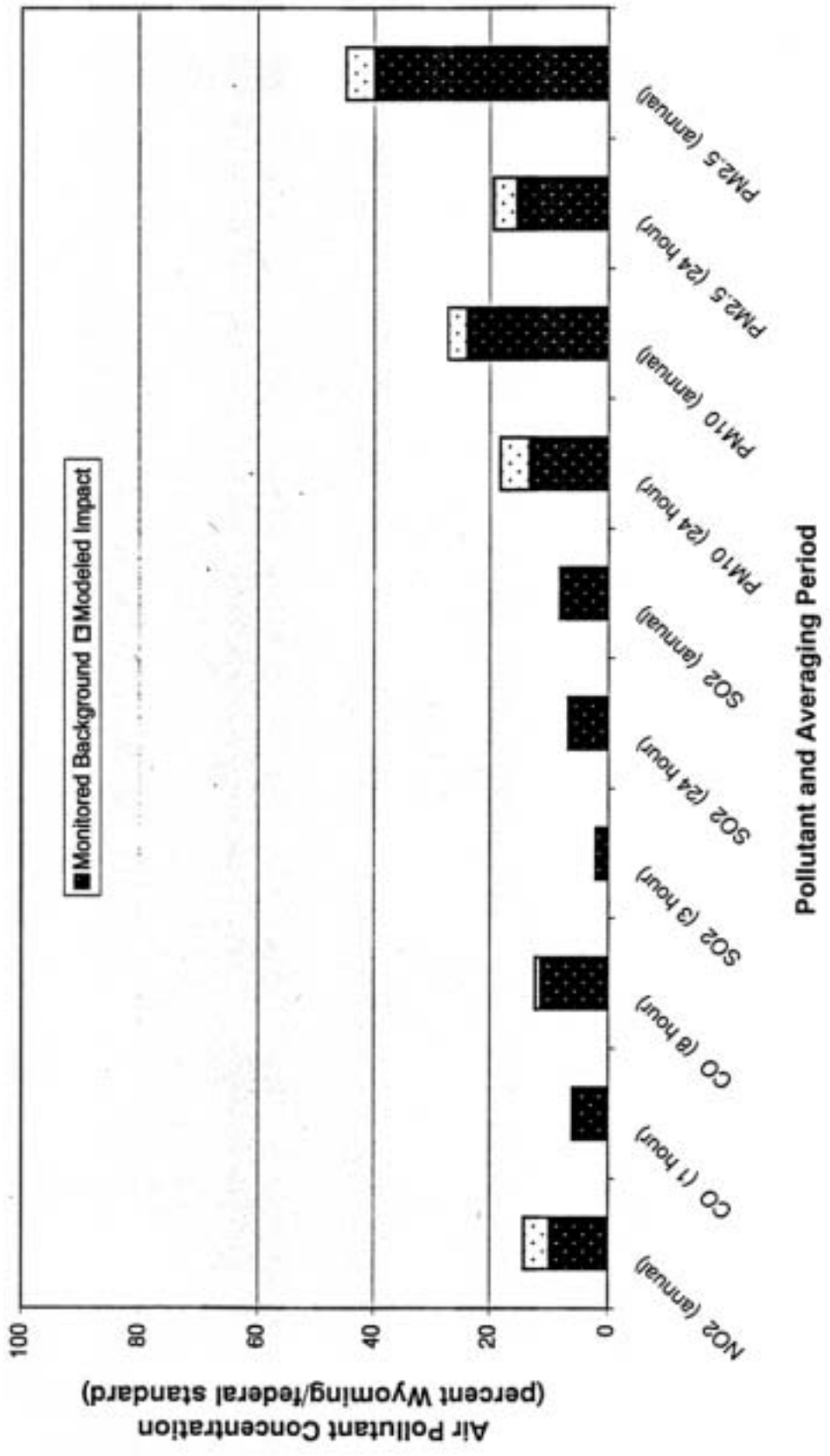


Figure 4-3 Gas Plant and Well Field Impact

designated threshold level of 1 in one million. For the maximum exposure scenario (20 years continuous outdoor exposure), the incremental cancer risk is 1.6 in one million, slightly greater than the threshold level of 1 in one million. Since the maximum exposure scenario is not reasonably likely to occur, potential incremental carcinogenic impacts are not expected to be significant.

Table 4-9. Short-Term Hazardous Air Pollutant Impacts

Hazardous Air Pollutant	Combined Potential Impact from Gas Plant and Wells (8-hour Average) (: g/m^3)	Range of State Acceptable Ambient Concentration Limits (: g/m^3)	Percentage of Most Stringent Acceptable Ambient Concentration Limit	Percentage of Greatest Acceptable Ambient Concentration Limit
Benzene	31.21	30 to 714	104.0%	4.4%
Toluene	79.73	1,870 to 8,930	4.3%	0.9%
Ethylbenzene	42.81	4,340 to 43,500	1.0%	0.1%
Xylenes	55.9	2,170 to 10,000	2.6%	0.6%
n-Hexane	41.47	1,800 to 36,000	2.3%	0.1%
Formaldehyde	4.13	4.5 to 71	91.8%	5.8%

Table 4-10. Potential Incremental Carcinogenic Risk

Hazardous Air Pollutant	Incremental Carcinogenic Risk Resulting From The Maximum Exposure Scenario	Incremental Carcinogenic Risk Resulting From The Most Likely Exposure Scenario
Benzene	1.6 in one million	0.6 in one million
Formaldehyde	0.9 in one million	0.3 in one million

Ozone Sub-grid Analysis

Ozone is formed in the atmosphere through a series of complex nonlinear chemical reactions involving NO_X, VOC and sunlight. The EPA ozone formation screening methodology for point sources (Scheffe 1988) provides an estimate of the maximum potential incremental ozone concentration that could possibly occur due to emissions from the new sources. The maximum potential ozone increment is then added to the current existing maximum background ozone concentration and compared with the ozone standard to determine whether there is a potential for the new sources to cause an exceedance of the ozone standard. If the results of the screening methodology indicate a high potential for an exceedance, a refined analysis is required since the screening methodology is highly conservative.

The total project NO_X and VOC emissions (wells plus compression at full development) were used in the screening analysis. Construction emissions of VOC are much less than 50 tons per year, and are therefore not expected to cause an increase in ozone concentrations (per the screening methodology). The screening tables indicate a maximum potential ozone formation of 0.009 ppm, or 18 :g/m^3. When this maximum potential is added to the background concentrations, the total ozone concentrations are 162 :g/m^3 for the 1-hour average as compared to a standard of 235 :g/m^3 and 157 :g/m^3 for the 8-hour average which is equivalent to the 8-hour standard. The results are shown in Table 4-11. In consideration of the conservatism of the estimates and screening methodology, it is not expected that exceedances of the ozone standards would occur.

There are several reasons why the ozone calculations are highly conservative: (1) the VOC/NO_X screening tables were designed to estimate the maximum ozone increment from a point source which occurs under background meteorological conditions far different than what occurs in southwestern Wyoming; (2) the project maximum hourly VOC emissions were used in the analysis while the actual daily emissions would be lower; and (3) the project sources were treated as a point source in the analysis when in reality their emissions would be more dispersed; and (4) the Scheffe method was developed for the 1-hour ozone standard while 8-hour average concentrations would be slightly lower.

Table 4-11. Potential Ozone Impact

Pollutant	Averaging Period	Gas Plant and Well Field Impact (:g/m^3)	Monitored Back-ground Level (:g/m^3)	Maximum Impact Plus Back-ground (:g/m^3)	National Ambient Air Quality Standard (:g/m^3)	Wyoming Ambient Air Quality Standard (:g/m^3)	Colorado Ambient Air Quality Standard (:g/m^3)	Percentage of Most Stringent Ambient Air Quality Standard
O_3	1-hr	18	144	162	235	None	None	69%
O_3	8-hr	18	139	157	157	157	157	100%

4.2.3.1.3 Alternative A Near-Field Impact Analysis

The CALPUFF set of models was applied in a near-field mode (4 to 50 km) to estimate short-term (less than or equal to 24-hour) and long-term (annual) regulated pollutant concentrations for comparisons with federal and state ambient air quality standards within 50 km of the DFPA (Table 4-12 and Figure 4-4). The results are also compared to the PSD Class II increments (Table 4-13).

The maximum predicted concentrations for all PSD pollutants range from much less than 1 percent (for SO_2) to 16% (for PM_{10}) of the applicable PSD Class II increments. When the maximum estimated concentrations are added to the existing maximum background concentrations, the total estimated concentrations for all regulated pollutants are also less than the applicable federal and state ambient air quality standards. Therefore, potential pollutant concentrations that may result from the project are not expected to cause significant impacts within 30 miles of the project area.

4.2.3.1.4 Alternative A Impacts Within the Monument Valley Management Area

Potential air quality impacts within MVMA were not directly assessed. However, Alternative A impacts within MVMA would not exceed the gas plant and well field impacts previously presented in Tables 4-6 and 4-7. Similarly, support road, ozone, and HAP impacts would not exceed the previously discussed levels.

Table 4-12. Alternative A Near-Field Ambient Air Quality Impacts

Pollutant	Averaging Period	Total Project Impact (: g/m^3)	Monitored Back-ground Level (: g/m^3)	Maximum Impact Plus Back-ground (: g/m^3)	National Ambient Air Quality Standard (: g/m^3)	Wyoming Ambient Air Quality Standard (: g/m^3)	Colorado Ambient Air Quality Standard (: g/m^3)	Percentage of Most Stringent Ambient Air Quality Standard
NO_2	Annual	1.51	10	11.51	100	100	100	12%
SO_2	3-hour	0.15	29	29.15	1,300	1,300	700	4%
SO_2	24-hour	0.08	18	18.08	365	260	365	7%
SO_2	Annual	0.02	5	5.02	80	60	80	8%
PM_{10}	24-hour	4.88	20	24.88	150	150	150	17%
PM_{10}	Annual	1.55	12	13.55	50	50	50	27%
$PM_{2.5}$	24-hour	1.65	10	11.65	65	NA	NA	18%
$PM_{2.5}$	Annual	0.48	6	6.48	15	NA	NA	43%

Note: $PM_{2.5}$ background assumed to be one-half of PM_{10} background.

Table 4-13. Alternative A Near-Field Increment Comparison

Pollutant	Averaging Time	Total Project Impact (: g/m^3)	PSD Class II Increment (: g/m^3)	Percentage of Class II Increment (: g/m^3)
NO_2	Annual	1.51	25	6%
SO_2	3-hr	0.15	512	0.03%
SO_2	24-hr	0.08	91	0.1%
SO_2	Annual	0.02	20	0.1%
PM_{10}	24-hr	4.88	30	16%
PM_{10}	Annual	1.55	17	9%

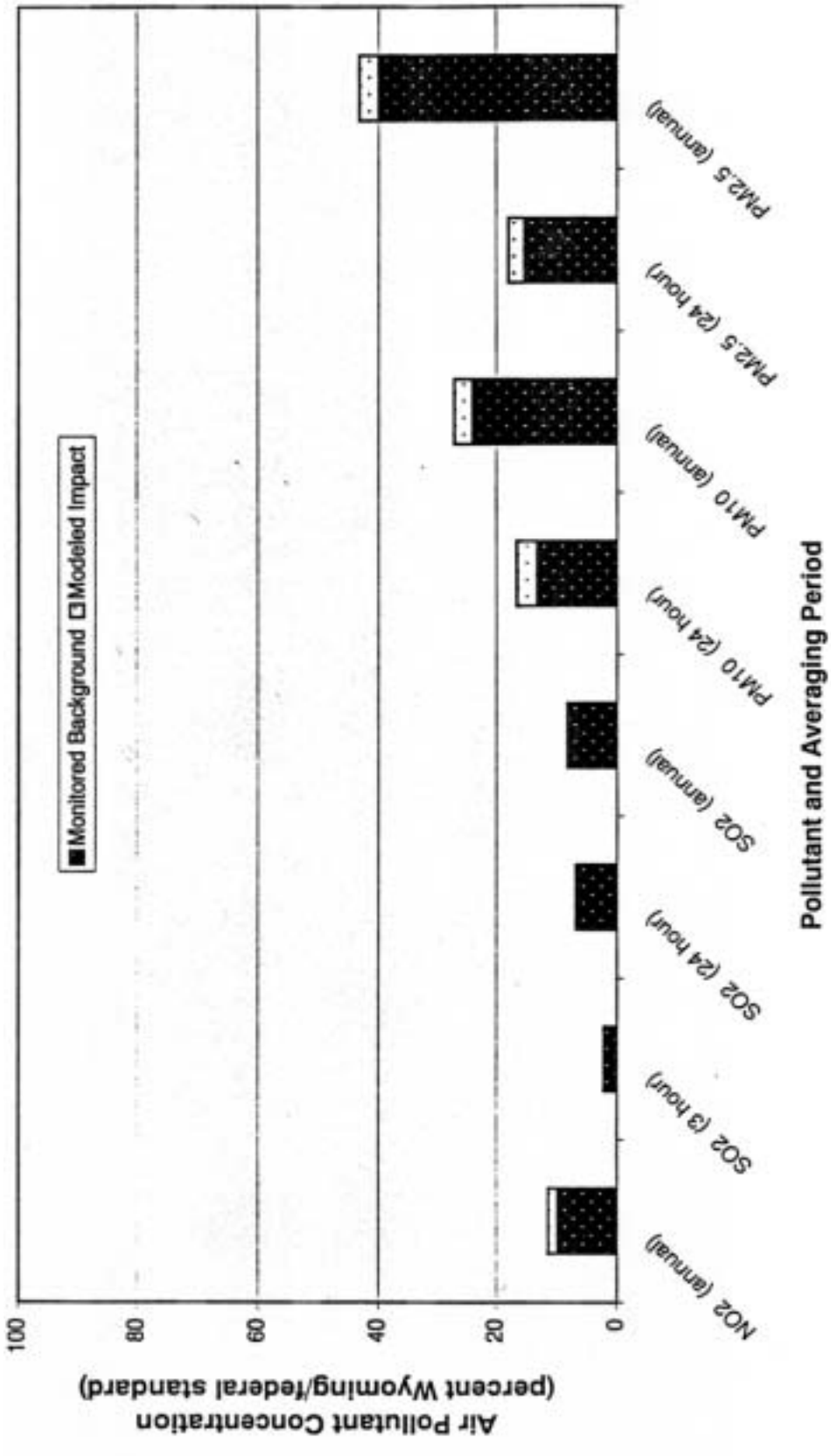


Figure 4-4 Alternative A Near-Field Ambient Air Quality Impacts

4.2.3.1.5 Alternative A Far-Field Impact Analysis

The CALPUFF model was also applied to estimate the far-field (50 km to over 200 km) ambient air quality and AQRV impacts from the Desolation Flats project. The far-field analysis estimates the total impacts due to the existing background and project sources. Impacts on air quality were estimated at nearby Class I and Class II areas. The sensitive areas include:

- Bridger Wilderness (Class I);
- Fitzpatrick Wilderness (Class I);
- Popo Agie Wilderness (Class II);
- Wind River Roadless Area (Class II);
- Dinosaur National Monument (Class II);
- Savage Run Wilderness (Class I);
- Mount Zirkel Wilderness (Class I), and
- Rawah Wilderness (Class I).

The model was used to estimate ambient NO_2, SO_2, PM_{10}, and $PM_{2.5}$ concentrations for comparison with federal and state ambient air quality standards and PSD Class I increments and to address potential AQRV impacts. The maximum impacts for all pollutants were found to occur at Dinosaur National Monument which is classified as a federal PSD Class II area. However, Colorado affords protection to that portion of Dinosaur National Monument within the state with the more stringent PSD Class I increments for SO_2. Table 4-14 and Figure 4-5 present the maximum impacts for the project sources and compare the results to the ambient standards. Regional background values were used for the comparison even though it is expected that the actual background concentrations in Dinosaur National Monument are less than the regional values assumed. The estimated concentrations for all pollutants are far below the applicable federal and state ambient air quality standards. In Table 4-15 the impacts for all pollutants at Dinosaur National Monument are compared to the more stringent PSD Class I increments although the Class I increments only apply to SO_2. The maximum concentration impacts due to project sources alone are less than one percent of the Class I increments. The far-field ambient concentration impact for all of the eight sensitive areas are provided in the Air Quality Technical Report.

Visibility Impacts

Far field impacts of project emissions on visibility degradation at the sensitive receptor areas was evaluated using the IWAQM/FLAG-recommended method (see the Air Quality Technical Report).

In this method, visibility degradation due to the project sources alone was compared against a background visibility condition based on the mean of the 20 percent cleanest days from a long-term period. Two long-term background data sets were available, one at Bridger Wilderness area and one at Mount Zirkel Wilderness area. The Bridger data period was for 1987 through June 30, 1995. The Mount Zirkel data were for the period 1994 to 1997. The Bridger data were used to represent background conditions at Bridger, Fitzpatrick, and Popo Agie Wilderness Areas and the Wind River Roadless Area. The Mount Zirkel data were used to represent conditions in Dinosaur National Monument and the Mount Zirkel, Savage Run, and Rawah Wilderness Areas.

There are two thresholds of visibility change which are used for determining the significance of potential impacts: the number of days in which the deciview change ( ) dv) is 1.0 or greater; and the number of days in which the) dv change is 0.5 or greater. The FS uses the 0.5) dv as a LAC

threshold in order to protect visibility in sensitive areas. The 1.0) dv threshold is used in the Regional Haze Regulations as a small but just noticeable change in haziness and has been used by other agencies as a management threshold. The 0.5 and 1.0) dv thresholds are neither standards nor regulatory limits. Rather, they are used to alert the affected land managers that potential adverse visibility impacts may exist and the land manager may wish to look at the magnitude, duration, frequency, and source of the impacts in more detail in order to make a

Table 4-14. Alternative A Far-Field Ambient Air Quality Impacts

Pollutant	Averaging Period	Total Project Impact (: g/m^3)	Monitored Back-ground Level (: g/m^3)	Maximum Impact Plus Back-ground (: g/m^3)	National Ambient Air Quality Standard (: g/m^3)	Wyoming Ambient Air Quality Standard (: g/m^3)	Colorado Ambient Air Quality Standard (: g/m^3)	Percentage of Most Stringent Ambient Air Quality Standard
NO_2	Annual	0.011	10	10.011	100	100	100	10%
SO_2	3-hour	0.017	29	29.017	1,300	1,300	700	4%
SO_2	24-hour	0.003	18	18.003	365	260	365	7%
SO_2	Annual	0.0001	5	5.0001	80	60	80	8%
PM_{10}	24-hour	0.033	20	20.033	150	150	150	13%
PM_{10}	Annual	0.00007	12	12.00007	50	50	50	24%
$PM_{2.5}$	24-hour	0.044	10	10.044	65	NA	NA	15%
$PM_{2.5}$	Annual	0.0009	6	6.0009	15	NA	NA	40%

Note: $PM_{2.5}$ background assumed to be one-half of PM_{10} background.

Table 4-15. Alternative A PSD Class I Increment Comparison

Pollutant	Averaging Time	Maximum Project Impact (: g/m^3)	PSD Class I Increment (: g/m^3)	Percentage of Class I Increment (: g/m^3)
NO_2	Annual	0.011	2.5	0.4%
SO_2	3-hr	0.017	25	0.07%
SO_2	24-hr	0.003	5	0.06%
SO_2	Annual	0.0001	2	0.005%
PM_{10}	24-hr	0.033	8	0.4%
PM_{10}	Annual	0.00007	4	0.002%

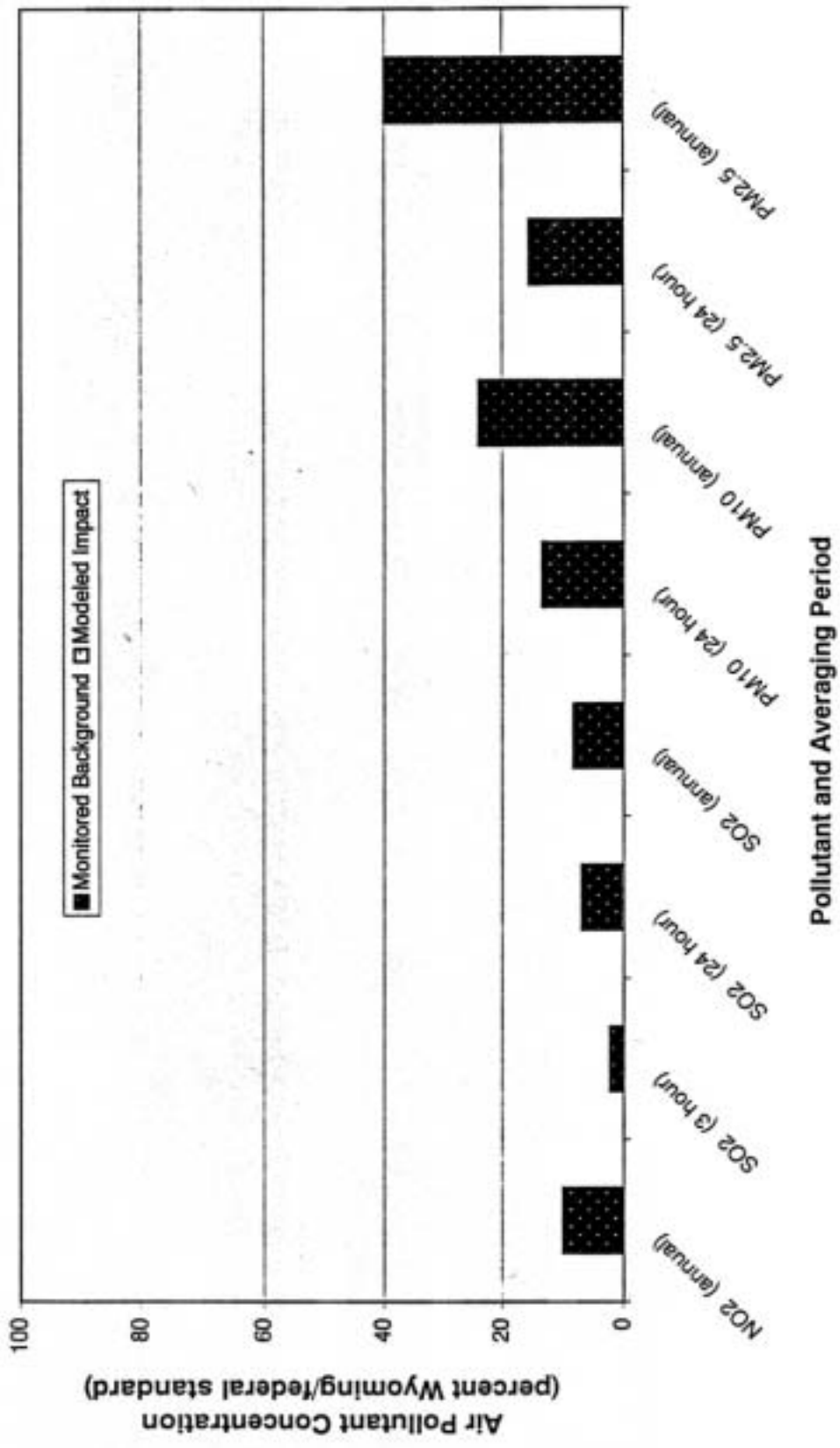


Figure 4-5 Alternative A Far-Field Ambient Air Quality Impacts

significance determination. The maximum deciview change due to the Desolation Flats project emissions alone is 0.239) dv at Dinosaur National Monument (a PSD Class II area), as shown in Table 4-16. Therefore, the estimated visibility impacts due to the project alone do not exceed the LAC thresholds of 0.5 or 1.0) dv.

Table 4-16. Alternative A Predicted Visibility Impacts From the Project

Sensitive Receptor Area	Maximum Visibility Impact ( ) dv)	Visibility Significance Criteria ( ) dv)	Number of Days Greater Than 0.5) dv	Number of Days Greater Than 1.0) dv
Bridger Wilderness	0.079	0.5 / 1.0	0	0
Fitzpatrick Wilderness	0.046	0.5 / 1.0	0	0
Wind River Roadless Area	0.048	0.5 / 1.0	0	0
Popo Agie Wilderness	0.073	0.5 / 1.0	0	0
Dinosaur National Monument	0.239	0.5 / 1.0	0	0
Savage Run Wilderness	0.115	0.5 / 1.0	0	0
Mount Zirkel Wilderness	0.093	0.5 / 1.0	0	0
Rawah Wilderness	0.079	0.5 / 1.0	0	0

Acid Deposition and Impacts

The potential impact of the project emission sources on acid deposition were analyzed using the Fox (1989) method (see Air Quality Technical Report). This method was used to estimate the potential change in ANC at each of 12 sensitive lakes (Table 4-17). This approach uses a set of equations to estimate how added deposition may change lake ANC from monitored baseline conditions. This approach assumes that ANC generation is constant, and does not factor in watershed buffering ability, lake flushing time or aquatic ecosystem bio-geochemistry. However, it does provide a conservative estimate for potential changes in lake ANC.

For lakes with background minimum measured ANC values of 25 : eq/l or greater, the FS has identified a LAC threshold of 10 percent change. For lakes with a minimum ANC background of less than 25 : eq/l, the FS has identified a LAC threshold of 1 : eq/l. Of the twelve lakes analyzed, three have ANC background less than 25 : eq/l. Table 4-17 presents the results of the analysis and indicates that the potential change in sensitive lake ANC is much less than the levels of acceptable change. Therefore, potential changes in lake ANC due to project impacts alone are not expected to be significant.

4.2.3.2 Proposed Action

Under the Proposed Action, 385 wells would be developed with an expected success rate of 65 percent or 250 producing wells. The Proposed Action represents a 35 percent reduction in well development when compared to Alternative A and it is expected that compression requirements for the Proposed Action would also be reduced by a similar percentage. Potential air quality impacts resulting from the implementation of the Proposed Action would be less than those previously described for Alternative A. No significant adverse impacts to air quality are anticipated as a result of the implementation of the Proposed Action.

Table 4-17. Alternative A Potential Acid Deposition Impacts

Sensitive Lake	Sensitive Area	Monitored Background ANC (: eq/l)	Level of Acceptable Change	Change In ANC (: eq/l)	Percentage of LAC
Black Joe Lake	Bridger Wilderness	69.0	10% (6.9 : eq/l)	0.008	0.12%
Deep Lake	Bridger Wilderness	61.0	10% (6.1 : eq/l)	0.008	0.13%
Hobbs Lake	Bridger Wilderness	68.0	10% (6.8 : eq/l)	0.005	0.07%
Upper Frozen Lake	Bridger Wilderness	5.7	1 : eq/l	0.008	0.80%
Ross Lake	Fitzpatrick Wilderness	61.4	10% (6.1 : eq/l)	0.004	0.07%
Lower Saddlebag	Popo Agie Wilderness	55.5	10% (5.6 : eq/l)	0.010	0.17%
Pothole A-8	Mount Zirkel Wilderness	16.0	1 : eq/l	0.037	3.70%
Seven Lakes	Mount Zirkel Wilderness	35.5	10% (3.6 : eq/l)	0.069	1.92%
Upper Slide Lake	Mount Zirkel Wilderness	24.7	1 : eq/l	0.039	3.90%
West Glacier Lake	Medicine Bow	26.1	10% (2.6 : eq/l)	0.044	1.69%
Island Lake	Rawah Wilderness	64.6	10% (6.5 : eq/l)	0.031	0.47%
Rawah #4 Lake	Rawah Wilderness	41.2	10% (4.1 : eq/l)	0.032	0.78%

4.2.3.3 Alternative B - No Action

Impacts to air quality under the No Action Alternative would occur at allowable levels and no significant impacts are anticipated. Actions approved under the Mulligan Draw EIS and Dripping Rock / Cedar Breaks EA may still be completed within the project area. Completion of the previously approved actions and individual APD's that would be approved on a case-by-case basis are expected to be less than Alternative A and the Proposed Action. In the absence of further development in the DFPA, no additional project related air quality impacts would occur.

4.2.4 Impacts Summary

No significant adverse impacts to air quality from the project alone are anticipated as a result of the implementation of the Proposed Action, Alternative A or the No Action Alternative. Localized increases in criteria pollutants would occur, but maximum concentrations would be below applicable federal and state standards. Similarly, hazardous air pollutant concentrations and incremental increases in cancer risk would also be below applicable significance levels. Potential impacts to visibility and acid neutralizing capacity would be below the levels of acceptable change.

4.2.5 Additional Mitigation Measures

Potential air quality impacts resulting from the project could be reduced through the implementation of engineering controls or other measures.

NO_X Mitigation

The primary sources of NO_X emissions associated with the project are diesel-fueled drilling rigs and natural gas-fueled compressor engines. The following mitigation measures could reduce impacts from NO_X emissions.

- The number of wells drilled each year could be restricted to a level below the 45 wells per year estimated in the analysis. By drilling fewer wells per year, the NO_X emissions would be dispersed over a greater period of time, lessening the potential impacts.

- In theory, the diesel-fueled engines currently in use on drill rigs could be replaced with cleaner burning natural gas-fueled engines. However, such equipment is not commercially available.

- For compressor engines, the WDEQ-AQD accepts a NO_X emission rate of 1.0 g/hp-hr as Best Available Control Technology. With the application of non-selective catalytic reduction, NO_X emissions for some compressor engines can be reduced to 0.7 g/hp-hr, a potential 30% reduction in compressor emissions.

- Compressors powered by electric motors could reduce NO_X emissions within the project area. However, increased NO_X emissions are likely to occur at the point of electrical generation. Solar powered generators are not technically feasible at this time.

- Project related NO_X emissions could be offset though the application of controls at non-project sources.

Particulate Matter Mitigation

The primary project related sources of particulate matter result from vehicle travel on unpaved roads and wind erosion. The following mitigation measures could reduce project related impacts from particulate emissions.

- Roads and well locations constructed on soils susceptible to wind erosion could be appropriately surfaced to reduce the amount of fugitive dust generated by vehicle traffic.

- Water or other dust suppressants could be applied as necessary on unpaved roads and construction areas to reduce problem fugitive dust emissions.

- Operators could establish and enforce speed limits on all project related unpaved roads to reduce vehicle fugitive dust.

VOC and HAP Mitigation

The primary project related sources of VOC are flash emissions from condensate storage tanks and dehydrator still vent emissions. The following mitigation measures could reduce project related impacts resulting from VOC emissions.

- Central tanks batteries could be established and vapor recovery units installed to capture storage tank flash emissions. The recovered flash emissions could then be compressed and sold as product.

- Storage tank flash emissions and dehydrator still vent emissions could be controlled with flares or incinerators. While this control technology would reduce VOC and HAP emissions, increases in NO_X and CO emissions would result.

- Operators could institute measures to ensure that dehydrator glycol pumps operate at the most efficient rate. By preventing excessive glycol circulation rates, VOC and HAP emissions are minimized.

Monitoring

Monitoring by itself cannot mitigate air quality impacts. However, additional monitoring and emissions data can better support future impact analyses.

- The BLM could continue to cooperate with existing visibility and atmospheric deposition monitoring programs. The need for, and design of, additional monitoring programs could include the involvement of interagency committees on air quality and include the Southwest Wyoming Technical Air Forum (SWYTAF), EPA Region VIII, WDEQ-Air Quality Division, and industry leaders.

- The BLM in cooperation with the WDEQ-Air Quality Division could institute an emissions tracking inventory. The tracking of emissions would require close coordination between federal land managers and state air quality regulatory personnel to develop and maintain an accurate inventory.

4.2.6 Residual Impacts

Implementation of the Proposed Action or Alternative A would cause increased levels of pollutants in the ambient air. As previously discussed, the increased pollutant concentrations are not predicted to exceed ambient air quality standards or PSD increments. The increased pollutant concentrations from the project would not directly cause visibility or acid deposition impacts exceeding the applicable LAC.

With the implementation of one or more of the previously described additional mitigation measures, the emission of air pollutants would be reduced below the levels described for Alternative A. The amount of the potential emission reductions have not been calculated.

4.3 SOILS

4.3.1 Introduction

Impacts resulting from drill pad, access road, facility site, and pipeline ROW construction could include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, loss of topsoil productivity, and increased susceptibility of the soil to wind and water erosion.

4.3.2 Impact Significance Criteria

The Great Divide RMP (USDI-BLM 1990a) prescribes the following objectives and standard mitigation guidelines relative to soils and watershed management that relate to this project:

- maintain soil cover and productivity where they are adequate;
- increase soil cover and productivity where these are declining;
- implement intensive practices to mitigate salt and sediment loading;
- administer watershed management practices designed to meet soils, water, and air resource management objectives;
- prohibit surface disturbing activities on unstable areas unless it can be demonstrated that the instability can be alleviated. Specific unstable areas such as landslides, slumps, and areas exhibiting soil creep will be individually identified;
- no occupancy or other surface disturbance is allowed on slopes of more than 25 percent without written permission from the Administrative Officer (AO). When development is proposed on slopes of more than 25 percent, engineered drawings for construction, drainage design, and final contours proposed after rehabilitation will be required; and
- construction will not be allowed without written permission from the AO when soils are frozen or during periods when the soil material is saturated or when watershed damage is likely to occur.

The Green River RMP (USDI-BLM 1997), including the MVMA, outlines the following objectives and actions relative to soils:

- stabilize and conserve the soils;

- increase vegetation production;

- maintain or improve surface and groundwater quality;

- protect, maintain, or improve wetlands, floodplains, and riparian areas;

- design land uses and surface disturbing activities to reduce erosion and to maintain or improve water quality;

- conduct management in the planning area to emphasize:
  - reduction of sediment, phosphate, and salinity load in drainages where possible;
  - maintenance/improvement of drainage channel stability; and
  - restoring damaged wetlands.

- avoid areas where soils are highly erodible or difficult to reclaim;

- prepare site specific activity and implementation plans, as needed;

- prepare activity implementation plans to include general watershed directives and incorporate sediment reduction and water quality improvement objectives;

- close 100-year floodplains, wetlands and riparian areas to any new permanent facilities;

- avoid surface disturbing activities that could adversely affect water quality and wetland or riparian habitat within 500 feet of, or on 100-year floodplains, wetlands, or perennial streams and within 100 feet of the edge of the inner gorge of intermittent and large ephemeral drainages; and

- implement practices, determined on a case-by-case basis, as needed to protect groundwater and prevent soil contamination.

Given the management objectives in the RMP's and as itemized above, the following criteria were used to determine the significance of impacts to soils within the DFPA:

- non-compliance with the RMP's;

- increased soil erosion that cannot be reduced by 50 percent after one year and by 75 percent after five years of soil disturbance;

- failure to have successful revegetation within three to five years of implementation;

- a reduction in soil productivity to a level that minimizes or prevents the disturbed area from recovering to pre-disturbance soil productivity levels; and

- location and construction of project facilities on sensitive soils (soils having one or more of the following characteristics: difficult reclamation potential, high erosion hazard, slope gradients greater than 25 percent, and moderate to high stability hazard) without the use of special construction methods.

4.3.3 Direct and Indirect Impacts

4.3.3.1 Proposed Action

The project activities listed above could result in adverse impacts to soils including the removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, loss of topsoil productivity, and increased susceptibility of the soil to wind and water erosion. These impacts could increase runoff, erosion, and off-site sedimentation. As described in the Soils Section of Chapter 3, (Section 3.3.2.1) approximately 66 percent of the DFPA falls into a sensitive soils category in regard to topsoil depth and quality, with limitations to road and facilities construction, rapid to very rapid runoff potential, and severe to very severe wind and water erosion potential. Prime farmland soils, as well as farmland soils of state and local importance, do not occur in the specific project area; however, such soils occur over relatively wide areas on the Little Snake River bottomlands where extensive irrigated hay lands occur. Such soils would not be directly or indirectly impacted by the proposed project, due to the implementation of erosion and sediment control measures. Because sensitive soil mapping units are distributed throughout the DFPA, total avoidance of these sensitive areas would not be feasible. Minimizing the location of facilities in sensitive areas, to the maximum extent possible, would be required to keep adverse impacts to an acceptable level.

Existing disturbance includes: 126.1 mi of primary roads (611.1 ac); 132.9 mi of secondary roads (322.3 ac); 402 mi of 2-track roads (194.5 ac); 82.2 mi pipeline (39.9 ac) and 338.6 areas of other disturbed areas. Therefore, a total existing disturbance within the DFPA area is 1,506.4 acres or 0.5% of the total project area.

Construction of the Proposed Action would variously disturb approximately 4,923 acres of soil. This total area of temporary disturbance would comprise approximately 2.1 percent of the 233,542 acre project area. Combined with the existing disturbance of 1,506.4 acres, total disturbance would be approximately 6,429.4 acres or 2.8 percent of the 233,542 acre project area. However, as discussed subsequently, this total area of temporary disturbance would be reduced through successful reclamation.

Once a well goes into production, the size of the drill pad can be reduced to approximately 1.4 acres. The unused portion of the drill pad (cut and fill slopes, subsoil and topsoil piles, reserve pit, and portions of the drill pad) would be reclaimed as described in Chapter 2. Similarly, a portion of the combined roadway/pipeline construction ROW would be reclaimed upon production. It is assumed that all pipeline disturbances would be reclaimed while only the crown of new roads would not be reclaimed.

During the life of the project (30-50 years), total disturbances would be reduced to 2,139 acres (336 acres associated with 235 wells having 1.4 acres of remaining disturbance per well site, 1,706 acres of roads [this assumes a 65 percent drilling success rate with roads to unsuccessful wells being reclaimed] and 97 acres of surface disturbance associated with ancillary facilities) or approximately 0.92 percent of the 233,542 acre project area.

Well pads would be reclaimed to the 1.4 acre of disturbance/well and remaining disturbed road dimensions would be approximately 16.0 feet wide, or 0.6 acres per well, and 0.0 acres for pipelines. The ancillary facility would not be reclaimed since the full size of the site would be needed during production. These remaining disturbance areas would represent approximately 2,139 acres or 0.92 percent of the total project area. This disturbance would be combined with the

existing disturbance of approximately 1,506.4 acres for a total of 3,645.4 acres, or 1.6 percent of the 233, 542 acre project area. This long-term disturbance would not preclude achievement of the objectives.

Increased soil susceptibility to erosion would occur in newly disturbed areas. Soil compaction caused by equipment traffic or by increased raindrop impact after loss of surface cover may decrease infiltration and water storage capacity, increase runoff, and reduce soil productivity. Increased surface runoff and erosion would occur primarily in the short term and would decline in time due to natural stabilization. Increases in surface runoff would also depend on the success of mitigation measures.

Topsoil quality in the DFPA is generally fair with coarse fragment content, sand content, clay content, shallow topsoil depths, high erodibility, and droughtiness being the primary limitations to successful reclamation. Areas such as badlands have a very low reclamation potential with high clay and/or salinity concerns. In addition to these limitations, low annual precipitation and wind and water erosion could make successful reclamation more difficult to attain. Therefore, the overall potential for successfully stabilizing disturbed soils is poor to fair. Field reconnaissance and review of existing reclamation in the project area suggests that successful reclamation can be attained with aggressive reclamation measures and follow-up monitoring and remediation.

Since specific sites have not yet been identified for wells, pipelines, and roads, Table 3-11 indicates the likelihood of encountering soil limitations that would require special attention. A large portion of the project area would likely experience difficulties during revegetation due to the presence of excess sodium and/or clay in the soil. In addition, the droughty nature of the soils would further limit reclamation potential. Excessive areas of sand, clay, and wetness would be avoided by final siting choices.

Slopes rated slightly severe or greater occupy at least 11.4 percent (all badlands or 26,623.8 acres) and a much smaller percent of residual slopes and flats within the overall project area. In nearly half of the instances of severe slope, shallow depth to rock and/or high sand content may be anticipated as a further complication.

Indirect impacts from off-road use of vehicles include vegetal cover destruction, as well as rutting and compaction of the soil. Given the sensitivity of the soils indicated in Table 3-11, unauthorized off-road vehicle use should be restricted per BLM guidance.

These potential adverse impacts of the proposed project could reduce soil productivity, impair successful revegetation, and result in increased erosion potential. Successful revegetation through applied surface runoff, erosion, and sediment control measures, and effective revegetation efforts would reduce the potential for soil productivity loss. Soil erosion is likely to be a primary adverse impact of these project effects. Erosion can impede successful revegetation, result in a loss of site productivity, and impair water quality if eroded sediment is transported to surface water bodies. In addition, some soils and geologic units may have relatively high levels of selenium. Erosion of selenium-laden sediment could increase selenium loading of streams.

Existing literature estimates soil loss tolerance within the general area of the project at 1.5 t/ac/yr; losses exceeding this amount would lower soil productivity (USDI-BLM 1987). As discussed in Water Resources, Section 3.4.2.2. of Chapter 3, sediment delivery has been estimated by the BLM to be approximately 0.35 ac-ft per square mile per year or 1.4 t/ac/yr. The majority of sediment

delivery originates from erosion and degradation of stream channels as opposed to soil erosion from upland areas.

Given the potential importance of soil erosion, the Universal Soil Loss Equation (USLE) (USDA-FS 1980) was used to evaluate land management practices and the potential soil erosion in the DFPA for roads (Israelson et al. 1980) and other land management activities (USDA-FS 1980). According to the South Baggs DEIS (USDI-BLM 1999c), natural baseline erosion was estimated to be approximately 1.5 t/ac/yr. This is an environmentally conservative estimate, and the true natural baseline erosion rates are likely less than the value presented here. This magnitude correlates with the BLM's estimate of 1.4 t/ac/yr. Most of the predicted eroded soil is contained on-site and is not transported off-site to streams.

New project facilities would be constructed with surface runoff, erosion, and sedimentation controls in place that would reduce erosion rates. The effect of applying control measures to reduce erosion was investigated by Grah (1989) through the use of the USLE to demonstrate the feasibility of erosion reduction. Control measures include the use of mulch, water bars, water turnouts, and effective revegetation. Applying control measures and assuming a reasonable success rate of 60% for reclamation, erosion from newly disturbed areas could be reduced (from the average unmitigated erosion rate established in the South Baggs DEIS, USDI-BLM 1999c) to 1.5, 1.8, and 2.3 t/ac/yr in the first year for drill sites, pipelines, and roads, respectively. As discussed previously, erosion would continue to decrease due to effective reclamation, natural stabilization, and a maturing vegetal cover. By the fifth year after construction, erosion in reclaimed areas would likely be reduced to 0.2, 0.5, and 0.5 t/ac/yr for well, pipelines, and roads, respectively. Erosion reductions for well sites and roads would be less than reductions for pipelines since exposed earth material that comprise the surface of these features would continue to be exposed to erosion. These numbers suggest that soil erosion could be reduced to non-significant levels with application of aggressive reclamation following the control measures recommended in Appendix C.

Table 4-18 summarizes total erosion that could occur under this alternative. With the application of erosion control measures, total erosion from the Proposed Action would be approximately 9,711.1 tons per year after the first year of construction and 1,999.2 tons after the fifth year. The natural baseline rate of erosion would yield 7,384.5 tons per year. These estimates assume that all construction would occur in the first year of project authorization. As discussed in Chapter 2, project development would occur over a 30-50 year period. Therefore, the total estimated erosion would be distributed over this longer period of time and would be less than the environmentally conservative analysis.

Wind erosion could also be an adverse effect of project development given the dominant sandy texture of the soils in portions of the project area. Soil loss due to wind erosion could add to the water erosion estimates. Chronic and severe wind erosion could occur in limited areas where roads and/or pipelines traverse sandy soil areas. Because these areas are particularly susceptible to "blow outs," special efforts to avoid such areas should be applied. Where avoidance is not feasible, special erosion control and soil stabilization measures should be applied as discussed in Appendix C.

Of particular importance in regards to potential soil impacts would be soils with high water tables and/or surface inundation. Bearing strengths in these soils is generally low and facilities placed in such areas could be subjected to damage. Placement of project facilities would need to avoid these areas. In order to preclude significant impacts, roads, drill/well sites, and pipelines should

Table 4-18. Soil Erosion Rates and Total Erosion by Alternative.

		Erosion rates (t/ac/yr)*		
Facility	**Area (acres)**	**Natural Baseline Rate of Erosion**	**Reclamation With Erosion Control: Year 1**	**Reclamation With Erosion Control: Year 5**
Well Pads	-	1.5	1.5	0.2
Compressor Stations	-	1.5	1.5	0.2
Pipelines	-	1.5	1.8	0.5
Roads	-	1.5	2.3	0.5
Predicted Erosion (t/y)				
Proposed Action (t/y)				
Well Pad	1,444	2,166.0	2,166.0	288.8
Compressor Station	97	145.5	145.5	19.4
Pipelines	758	1,137.0	1,364.4	379.0
Roads	2,624	3,936.0	6,035.2	1,312.0
TOTAL	4,923	7,384.5	9,711.1	1,999.2
Alternative A (t/y)				
Well Pad	2,220	3,330.0	3,330.0	444.0
Compressor Station	161	241.5	241.5	32.2
Pipelines	1,166	1,749.0	2,098.8	583.0
Roads	4,035	6,052.5	9,280.5	2,017.5
TOTAL	7,582	11,373	14,950.8	3,076.7
Alternative B (t/y)				
Well Pad	**	**	**	**
Compressor Station	**	**	**	**
Pipelines	**	**	**	**
**Roads	**	**	**	**
****TOTAL**	**	**	**	**

*Erosion rates from South Baggs DEIS (USDI-BLM 1999c).

** Determined as APD's are granted.

not be placed in areas with steep slopes greater than 25 percent and in areas with badland soils. Therefore, significant impacts are not expected to occur with implementation of the Proposed Action.

4.3.3.2 Alternative A

Under Alternative A, the DFPA would have a maximum of: 2,220 acres of new surface disturbance from well locations (including on-site gathering, measurement, and dehydration facilities); 833 miles (4,035 acres) of new roads or upgrades of existing roads, 555 miles (1,166 acres) of new pipeline- and approximately 161 acres of new surface disturbance from ancillary facilities (i.e., 6 compressor stations [24 acres], 2 gas processing plant [60 acres], 4 water evaporation ponds [16 acres], 3 disposal wells [21 acres], and 16 water wells [40 acres]). Total new short-term surface disturbance resulting from Alternative A would be 7,582 acres (approximately 3.2 percent of the project area).

Construction under Alternative A would variously disturb approximately 7,582 acres of soils. This total area of temporary disturbance would comprise approximately 3.2 percent of the 233,542 acre project area. Combined with the existing disturbance of 1,506.4 acres, total project area disturbance would be approximately 9,088.4 acres or 3.9 percent of the 233,542 acre project area. However, as discussed subsequently, this total area of temporary disturbance would be reduced through successful reclamation.

During the life of the project (30-50 years), total disturbances would be reduced to 3,300 acres (516 acres associated with 361 wells having 1.43 acres of remaining disturbance per well site, 2,623 acres of roads [this assumes a 65 percent drilling success rate with roads to unsuccessful wells being reclaimed] and 161 acres of surface disturbance associated with ancillary facilities) or approximately 1.4 percent of the project area.

Well pads would be reclaimed to the 1.4 acre of disturbance/well and remaining disturbed road dimensions would be approximately 16.0 feet wide, or 0.6 acres per well, and 0.0 acres for pipelines. The ancillary facility would not be reclaimed since the full size of the site would be needed during production. These remaining disturbance areas would represent approximately 3,300 acres or 1.4 percent of the total project area. This disturbance would be combined with the existing disturbance of approximately 1,506.4 acres for a total of 4,806.4 acres, or 2.1 percent of the project area.

The same types of soils impacts would occur under this alternative as with the Proposed Action. The amount and duration of such impacts would depend on the locations of the wells and access roads. As discussed previously, it would be very difficult to totally avoid all sensitive soil areas. Slopes greater than 25 percent, badland soils, and sandy soils should be totally avoided. Therefore, where the other sensitive soils cannot be avoided, special construction techniques and mitigation measures should be applied to reduce the probability of significant soils impacts.

Erosion rates would be essentially the same for this alternative as for the Proposed Action since the same types of construction activities would occur. However, total erosion would be increased due to the larger area of disturbance under this alternative. Table 4-18 summarizes total erosion that could occur under this alternative with and without erosion control measures. With the application of erosion control measures, total erosion under this alternative would be approximately 14,950.8 tons per year after the first year of construction and 3,076.7 tons after the fifth year. These estimates assume that all construction would occur in the first year of project authorization. As

discussed in Chapter 2, project development would occur over a 30-50 year period. Therefore, the total estimated erosion would be distributed over this period of time and would be less than the environmentally conservative analysis. These calculations suggest that soil erosion could be reduced to non-significant levels identified in the significance criteria with application of the control measures itemized in Appendix C. Therefore, significant impacts are not expected to occur with implementation of Alternative A.

4.3.3.3 Alternative B - No Action

Under the No Action Alternative, soils would be impacted similar to that described for the action alternatives, at levels previously authorized for Mulligan Draw and Dripping Rock, and on a case-by-case basis in other areas of the DFPA. Similar erosion, runoff, and sediment control and revegetation measures would be applied to minimize adverse impacts to soils. Such methods would likely reduce impacts of the No Action Alternative to non-significant levels.

4.3.4 Impact Summary

Implementation of the Proposed Action would affect 4,923 acres (2.6% of the total DFPA) of soils during project construction, while implementation of Alternative A would affect 7,582 acres (3.2% of the total DFPA) of soils. First year erosion levels would be approximately 9,711.1 tons for the Proposed Action and 14,950.8 tons for Alternative A, while fifth year erosion levels would decrease to 1,999.2 tons and 3,076.7 tons, respectively. This erosion would be in addition to the natural baseline erosion as well as the erosion occurring due to existing disturbance in the DFPA. These impacts would be kept to non-significant levels with application of the mitigation measures in Chapter 2 and the control measures recommended in Appendix C.

4.3.5 Additional Mitigation Measures

With measures identified in Chapter 2 and additional measures proposed in Chapter 4 (i.e. vegetation and wetlands, water resources), no additional mitigation measures for soils are required.

4.3.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2, no residual impact discussion is required. Impacts would remain the same as described in Section 4.3.3.

4.4 WATER RESOURCES

4.4.1 Introduction

Authorization of the proposed project would require full compliance with the GDRMP and GRRMP directives that relate to surface and groundwater protection, EO 11990 (floodplains protection), and the Federal CWA in regard to protection of water quality compliance with Section 404. These regulations require that certain permits/authorizations be obtained for project authorization including an NPDES permit for discharge of produced water; a surface runoff, erosion, and sedimentation control plan; an oil spill containment and contingency plan; and CWA Section 404 permits.

4.4.1.1 Surface Water

Potential impacts that could occur to the surface water system due to the proposed project include increased surface water runoff and off-site sedimentation due to soil disturbance (Soils Section 4.3), water quality impairment of surface waters, and stream channel morphology changes due to road and pipeline crossings. The magnitude of the impacts to surface water resources would depend on the proximity of the disturbance to a drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration of time within which construction activities occur, and the timely implementation of effective mitigation measures. Impacts would likely be greatest shortly after the start of construction activities and would likely decrease in time due to stabilization, reclamation, and revegetation efforts. Construction activities would occur over a relatively short period of time; therefore, the majority of the disturbance would be intense but short-lived. A Spill Prevention, Control, and Countermeasure Plan would be implemented to prevent petroleum products and other chemicals from contaminating surface waters. If deemed necessary, reserve and evaporative pits would be lined to prevent drilling fluids and produced water from contaminating surface waters.

4.4.1.2 Groundwater

The proposed state-of-the-art drilling and completion techniques make it unlikely that aquifer contamination would occur during drilling. Should aquifer mixing occur, the magnitude of mixing would be relatively small due to the relatively short period of time drilling is conducted. A Spill Prevention, Control, and Countermeasure Plan would be implemented to prevent petroleum products and other chemicals from contaminating groundwater aquifers. If deemed necessary, reserve and evaporative pits would be lined to prevent drilling fluids and produced water from contaminating aquifers.

4.4.2 Impact Significance Criteria

Impacts would be considered to be significant if the following were to occur:

- Non-compliance with the GDRMP (USDI-BLM 1990a), and the GRRMP (USDI-BLM 1997). Specifically, surface development would be prohibited within 500 feet of live streams, lakes, reservoirs, canals, and associated riparian habitat;

- Non-compliance with EO 11990, Protection of Floodplains.

- Degradation of water quality such that state standards outlined in the Rules and Regulations of the WQED-WQD are not met.

- Degradation of groundwater quantity in any freshwater aquifers regardless of use or non-use.

- Degradation of groundwater quality in any freshwater aquifers regardless of use or non-use.

- Alteration of channel geometry or gradients that produce undesirable effects such as aggradation, degradation, or side-cutting.

- Modification of the quantity and quality of streamflows such that it affects established users.

- Non-compliance with the CWA in regard to water quality and Section 404 permits.

4.4.3 Direct and Indirect Impacts

4.4.3.1 Proposed Action

4.4.3.1.1 Surface Water

The proposed project activities would result, to varying degrees, in the following impacts: vegetation removal, increased soil surface exposure, mixing of soil horizons, soil compaction and decreased infiltration capacity, loss of topsoil productivity, and increased susceptibility of the soil to wind and water erosion. These impacts may affect surface water resources by increasing surface runoff, erosion, and off-site sedimentation, which in turn would cause channel instability and degradation of surface water quality. As described in Chapter 2, total new short-term surface disturbance resulting from the Proposed Action would be 4,923 acres (approximately 2.1 percent of the total DFPA, which encompasses about 233,542 acres). This total would include 1,444 acres of new surface disturbance from well locations (including on-site gathering, measurement, and dehydration facilities), 2,624 acres of new roads or upgrades of existing roads, 758 acres of new pipeline construction, and approximately 97 acres of new ancillary facilities (i.e., four compressor stations on 16 acres, one gas processing plant on 30 acres, three water evaporation ponds on 12 acres, two disposal wells on 14 acres, and ten water wells on 25 acres). These disturbance areas are summarized in Table 4-18 of Section 4.3. The construction disturbance would not be uniformly distributed across the project area, but rather, project facilities would be located where the efficiency and feasibility of extracting the natural gas would be the highest. Combined with the existing disturbance of 1,506.4 acres, cumulative disturbance would be approximately 6,429.4 acres or 2.8 percent of the project area. However, as discussed subsequently, this total area of temporary disturbance would be reduced through successful reclamation.

The Proposed Action assumes the construction of 385 wells at 361 locations and associated roads and pipelines. Roads would be designed to minimize disturbance, and all surface disturbance would be contained within the road ROW. In the event drilling is non-productive, all disturbed areas, including the well site and new access road, would be reclaimed to the approximate landform that existed prior to construction. If drilling is productive, all access roads to the well site would remain in place for well servicing activities. Partial reclamation would be completed on segments of the well pad and access road ROW no longer needed. During the life of the project (30-50 years) total disturbances would be reduced to 2,139 acres (336 acres associated with 235 well sites having 1.4 acres of remaining disturbance per well site, 1,706 acres of roads [this assumes a 65 percent drilling success rate with roads to unsuccessful wells being reclaimed] and 97 acres of surface disturbance associated with ancillary facilities) or approximately 0.92 percent of the 233,542-acre project area. This disturbance would be combined with the existing disturbance of approximately 1,506.4 acres for a total of 3,645.4 acres, or 1.6 percent of the project area.

Of the 233,542 acres of land within the DFPA, most (154,104.2 acres or 66 percent) fall into a sensitive soils category in regard to topsoil depth and quality, with limitations to road and facilities construction, rapid to very rapid runoff potential, and severe to very severe wind and water erosion potential. The balance (79,437.8 acres or 34 percent) are non-sensitive soils. Table 3-11 provides an approximate breakdown of sensitivity by category, nature or sensitivity, and area. Sensitive soils include physical characteristics that relate to watershed stability, runoff potential, erosion potential, and surface runoff rates. By avoiding areas containing sensitive soils, the likelihood of causing

significant impacts is reduced.

Topsoil quality in the DFPA is generally fair with coarse fragment content, sand content, clay content, shallow topsoil depths, high erodibility, and droughtiness being the primary limitations to successful reclamation. Areas such as badlands have a very low reclamation potential with high clay and/or salinity concerns. In addition to these limitations, low annual precipitation and wind and water erosion could make successful reclamation in the DFPA more difficult to attain. However, field reconnaissance and review of existing reclamation in the project area suggests that successful reclamation can be attained with aggressive reclamation measures and follow-up monitoring and remediation.

Since specific sites have not yet been identified for wells, pipelines, and roads, Table 3-11 indicates the likelihood of encountering soil limitations that would require special attention. A large portion of the DFPA would likely experience difficulties during revegetation due to the presence of excess sodium and/or clay in the soil.

Slopes rated slightly severe or greater are likely to be encountered in the badlands and may be encountered elsewhere to a lesser extent within the project area. In nearly half of the instances of severe slope, shallow depth to rock and/or high sand content may be anticipated as a further complication.

Sediment delivery has been estimated by the BLM to be approximately 0.35 ac-ft per square mile per year or 1.4 t/ac/yr. The majority of sediment delivery originates from erosion and degradation of stream channels as opposed to soil erosion from upland areas. According to the South Baggs EIS (USDI-BLM 1999c), natural baseline erosion was estimated to be approximately 1.5 t/ac/yr. This is an environmentally conservative estimate, and the true natural baseline erosion rates are likely less than the value presented here. This magnitude correlates with the BLM's estimate of 1.4 t/ac/yr. Most of the predicted eroded soil is contained on-site and is not transported off-site to streams. The majority of soil disturbance would not be in proximity to stream channels as required by the RMP directive identified in Section 4.4.2.

According to the South Baggs EIS, the average unmitigated erosion rate could be as high as 13.8t/ac/yr for drill pads, 73.7 t/ac/yr for pipelines, and 5.8 t/ac/yr for roads. New project facilities would be constructed with surface runoff, erosion, and sedimentation controls in place that would reduce erosion rates. The effect of applying control measures to reduce erosion was investigated by Grah (1989) through the use of the USLE to demonstrate the feasibility of erosion reduction. Control measures include the use of mulch, water bars, water turnouts, and effective revegetation. Applying control measures and assuming a reasonable success rate of 60% for reclamation, erosion from newly disturbed areas could be reduced to 1.5, 1.8, and 2.3 t/ac/yr in the first year for drill sites, pipelines, and roads, respectively. As discussed previously, erosion would continue to decrease due to effective reclamation, natural stabilization, and a maturing vegetal cover. By the fifth year after construction, erosion would likely be reduced to 0.2, 0.5, and 0.5 t/ac/yr for well, pipelines, and roads, respectively with reclamation. This represents a 98 percent reduction for well sites, a 99 percent reduction for pipelines, and a 91 percent reduction for roads. Erosion reductions for well sites and roads would not decrease as much as for pipelines since exposed earth material that comprise the surface of these features would continue to be exposed to erosion. These calculations suggest that soil erosion could be reduced to non-significant levels identified in the significance criteria with application of aggressive reclamation following the control measures recommended in Appendix C.

Table 4-18 summarizes the total erosion that could occur under this alternative. With the application of erosion control measures, total erosion from the Proposed Action would be approximately 9,711.1 tons per year after the first year of construction and 1,999.2 tons after the fifth year. These estimates assume that all construction would occur in the first year of project authorization. As discussed in Chapter 2, project development would occur over a 20-year period. Therefore, the total estimated erosion would be distributed over this longer period of time and would be less than the environmentally conservative analysis.

As discussed in Chapter 3, most of the sediment yield originates from channel erosion and degradation due to infrequent high-intensity thunderstorm events. Even though this sediment delivery analysis indicates that sediment transport to a channel would likely be small, this sediment input combined with potential minor increases in surface runoff could increase the rate of channel sedimentation. Therefore, even with the predicted small quantity of sediment transport, such sediment must be managed in these sensitive watersheds by restricting all sediment to the site of erosion through the implementation of best management practices and mitigation.

Most of the ephemeral drainage channels identified on Figure 3-5 are classified as Waters of the U.S. Crossings of these channels and any associated wetlands would require authorization from the COE through the CWA Section 404 permitting process. However, these channel crossings would likely receive expedited authorization from the COE through General Permit 98-08, which authorizes activities associated with oil and gas exploration and development in the State of Wyoming. Other project facilities such as well sites and/or facilities sites would not be located in waters of the U.S., and therefore, Section 404 permitting would not be necessary for such facilities. No significant impacts would likely result given the assumptions and compliance with management identified previously, as well as the mitigation measures listed in Section 4.4.5.

There is a remote chance that road and pipeline construction across established channels could adversely modify flow hydraulics. However, with correct design of channel crossings, including design for 50-year runoff events, no adverse impacts are expected. As discussed in Chapter 3, most of the drainage channels in the project area are ephemeral. Therefore, it is unlikely that the quality of surface waters would be adversely affected by increased sedimentation. However, some increase in sediment discharge into the existing detention ponds (i.e., small stock reservoirs) within the project area could occur. This could result in loss of storage capacity of the ponds. The erosion analysis indicates that with successful implementation of control measures, no significant increase in channel sedimentation should occur. Thus, the storage capacity of the ponds should not be adversely impacted. There is a greater chance that a pond would be filled in with sediment from natural erosion processes, and to separate natural process sedimentation from human-induced sedimentation is beyond the scope of this EIS. If it were determined that the project causes loss of storage capacity or reduction in water quality, the operators would be required to compensate the water right holders by excavating the collected sediment in the pond and/or provide better quality water during the occurrence of the adverse impact. Most of the project could be constructed without adverse affect on water resources except in areas where project facilities cannot avoid sensitive soils areas as discussed in Section 4.3.

Reserve pits would be utilized to contain drilling fluids, cuttings, and wastewater produced from the well drilling operations. If necessary, the reserve pit would be lined with an impermeable liner to prevent seepage and possible contamination of surface and groundwater. As discussed in Section 4.3, many of the soils in the project area have a clay texture with low infiltration and permeability

rates. Therefore, not all reserve pits may require impermeable liners to prevent seepage. An impermeable membrane liner would be used where appropriate as defined during the APD review. The impermeable synthetic liner would be at least 12 mils thick, reinforced with a bursting strength of 174 x 175 pounds per inch (ASTMD 75719), resistant to decay from sunlight and hydrocarbons, and compatible with the drilling fluids to be retained. Leakage of the pit fluids would be minimal unless the liners were damaged. Thus, adverse impacts from reserve pits would likely not occur.

As described in Chapter 2, water would be required in most aspects of project construction including road construction, drill site construction, well drilling, and pipeline testing. Water for use in the project construction could be as high as 1,000 gallons per acre of disturbance, which would equate to about 15.1 ac-ft of water. Water used in the well-drilling process could be as high as 462,000 gallons, or about 1.4 ac-ft of water per well for a total of about 546 ac-ft (for 385 wells). The operators intend to use freshwater-based mud for the majority of their drilling operations. Water would also be used for hydrostatic testing of pipelines. Assuming one set of pipelines per well pad (single or multiple wells), and all pipelines associated with 361 well pads (1,906,080 feet of pipeline) would be hydrostatically tested at once and therefore water would not be re-used, approximately 15.4 ac-ft of water would be required for hydrostatic testing of pipelines. Therefore, total water demand with hydrostatic testing for the Proposed Action would be approximately 576.5 ac-ft. This total quantity of water would not be withdrawn all at one time; rather, this amount would be distributed over the construction phase that would extend over several years as discussed in Chapter 2. Water would be obtained from SEO-approved local surface water sources and/or water wells. As described in Chapter 3, there are presently 33 active permitted groundwater rights filed in the project area, 15 of which are for water wells that supply water for drilling deep oil and gas wells. There are over 120 cancelled and/or abandoned groundwater rights within the project area, essentially all of which were water wells used to supply water for oil and gas drilling. Seventeen of the other 18 active permitted groundwater rights in the project area are designated for livestock use. There are approximately 60 surface water right permits within the project area; all but 2 of which are associated with livestock water facilities. Roughly two-thirds of these permits are unadjudicated and the other third are adjudicated. These surface water rights total about 326 ac-ft per year. Historically, water wells have been the primary source of supply for oil and gas drilling in this arid area; it is likely that water wells would supply the proposed project drilling needs. The total water demand identified above would not likely adversely affect the existing surface water or groundwater rights in the project area provided full coordination is implemented with the SEO and the BLM. Again, the total water demand of 576.5 ac-ft by the project would be spread out over several years and would not cause significant adverse impacts on the surface water or groundwater resources within the DFPA.

Handling and management of hydrostatic test water, if used by the operators, would need to be accomplished in a manner that does not adversely affect soils, stream channels, and surface water and groundwater quality. After testing operations are completed, the water would be pumped into water-hauling trucks and transported to drilling locations within the project area to be used in conjunction with drilling operations or re-used for other aspects of the construction and/or production process. However, if such water is not re-used it must be disposed of in a manner where soil scouring and water quality impairment would not result. Hydrostatic test water is expected to be of relatively good quality; however, it should be evaluated for compliance with State water quality standards. No test water should be discharged unless such water meets these standards. Test water not needed for drilling operations that meets water quality standards would be disposed of onto undisturbed land having vegetative cover or into an established drainage channel in a manner as not to cause accelerated erosion. Further, use and disposal of hydrostatic

test water must comply with the mandatory ROW stipulation for hydrostatic testing as well as the POD, the CWA and the NPDES permit that would be required for the proposed project.

Methods used for the disposal of produced water (water produced in association with the gas which is separated out at the well location) would vary but would generally be accomplished by either (1) disposal in an underground injection well, (2) surface discharge, or (3) surface evaporation in lined or unlined ponds. The operators would obtain the permit(s) necessary (i.e., NPDES) for the selected disposal method. Depending on timing of availability, quantity, and quality of produced water; some of the produced water could be used in well drilling and completion, and pipeline construction and hydrostatic testing.

If a well is productive, site erosion and off-site sedimentation would be controlled by promptly revegetating sites in the first appropriate season (fall or spring) after drilling, and providing surface water drainage controls, such as berms, sediment collection traps, diversion ditches and erosion stops as needed. These measures would be described in the individual APD/ROW.

4.4.3.1.2 Groundwater

The geologic formation targeted in the DFPA is the Almond Formation. Drilling depths would vary from 9,800 to13,000 feet. Well drilling and completion should not have an adverse effect on groundwater quality if the project is in compliance with "Onshore Oil and Gas Order No. 2." State-of-the-art drilling and well completion techniques make the possibility of significant degradation of groundwater quality in any aquifer very low.

Well completion must be accomplished in compliance with "Onshore Oil and Gas Order No. 2" (43 CFR § 3164.1). These guidelines specify the following:

> "Proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use".

Usable water is defined by the onshore order as groundwater with a TDS of 10,000 ppm or less encountered at any depth (the State of Wyoming considers TDS of 5,000 ppm to be the limit on livestock use). To comply with the order, wells must be completed such that unusable water is isolated from usable water through the use of cementing and other proven technologies. Assuming compliance with this order, no contamination of usable groundwater would likely occur. Well drilling and completion as proposed in Chapter 2 appears to comply with the onshore order.

As discussed in Chapter 3, the SEO records identify 33 active permitted groundwater rights in the project area, 15 of which are for water wells that supply water for drilling deep oil and gas wells. The BLM is the applicant of 17 of the other 18 groundwater rights in the project area, 5 of which are developed springs. All 17 are designated for livestock use. Only 1 of the 33 groundwater rights is for domestic use. The majority of groundwater in use in the DFPA is obtained from Tertiary age units. This, combined with the improbable degradation of groundwater quality would essentially eliminate the potential occurrence of adverse impacts to any groundwater right holders near the DFPA.

It is unlikely that seeps or springs would be adversely affected by the Proposed Action, as these

water features are typically associated with shallow geologic units. However, locations of such surface water expressions of groundwater would be evaluated during the site-specific analysis conducted for all project components at the APD stage. All construction activities and storage of petroleum products would be kept away from seeps and springs. Therefore, contamination of seep and springs and groundwater would be unlikely.

4.4.3.2 Alternative A

The same types of adverse impacts discussed under the Proposed Action would occur under this alternative; however, the magnitude of such impact would be slightly greater. Projected short-term disturbances under this alternative would be increased to approximately 7,582 acres. These disturbance areas would represent approximately 3.2 percent of the total 233,542 acre project area. This total would include 2,220 acres of new surface disturbance from well locations (including on-site gathering, measurement, and dehydration facilities), 4,035 acres (833 miles) of new roads or upgrades of existing roads, 1,166 acres (555 miles) of new gas gathering pipelines, and 161 acres for ancillary facility sites. Combined with the existing disturbance of 1,506.4 acres, cumulative disturbance would be approximately 9,088.4 acres or 3.9 percent of the 233,542 acre project area.

However, this total area of temporary disturbance would be reduced through successful reclamation.

During the life of the project (30-50 years), total disturbances would be reduced to 3,300 acres (516 acres associated with 361 wells having 1.43 acres of remaining disturbance per well site, 2,623 acres of roads [this assumes a 65 percent drilling success rate with roads to unsuccessful wells being reclaimed] and 161 acres of surface disturbance associated with ancillary facilities) or approximately 1.4 percent of the 233,542 acre project area. This disturbance would be combined with the existing disturbance of approximately 1,506.4 acres for a total of 4,806.4 acres, or 2.1 percent of the project area.

The construction disturbance associated with Alternative A can also be distributed by the watershed. The Sand Creek watershed would sustain most of the 7,582 acres of disturbance. Assuming all of the projected disturbance was to occur within the Sand Creek watershed, this would equate to only about 2 percent of that drainage basin. Likewise, assuming all of the projected disturbance was to occur within the Barrel Springs Draw watershed, this would equate to only about 3.5 percent of that drainage basin.

The same types of soils impacts would occur under this alternative as with the Proposed Action. The amount and duration of such impacts would depend on the locations of the wells and access roads. As discussed previously, it would be very difficult to totally avoid all sensitive soil areas. Slopes greater than 25 percent, badland soils, and sandy soils should be totally avoided. Therefore, where the other sensitive soils cannot be avoided, special construction techniques and mitigation measures should be applied to reduce the probability of significant soils impacts.

Erosion rates would be essentially the same for this alternative as for the Proposed Action since the same types of construction activities would occur. However, total erosion would be increased due to the larger area of disturbance under this alternative. Table 4-18 summarizes total erosion that could occur under this alternative with and without erosion control measures. With the

application of erosion control measures, total erosion under this alternative would be approximately 14,950.8 tons per year after the first year of construction and 3,076.7 tons after the fifth year. These estimates assume that all construction would occur in the first year of project authorization. As discussed in Chapter 2, project development would occur over a 20-year period. Therefore, the total estimated erosion would be distributed over this period of time and would be less than the environmentally conservative analysis. These calculations suggest that soil erosion could be reduced to non-significant levels identified in the significance criteria with application of the control measures itemized in Appendix C. Therefore, significant impacts are not expected to occur with implementation of Alternative A.

Total water demand with hydrostatic testing for this alternative would be approximately 886 ac-ft. Water would be obtained from SEO-approved local surface water sources and/or water wells. The source of water for the proposed project would likely be, as it has been in the past, primarily from water supply wells. The total water demand identified above would not likely adversely affect the existing surface water or groundwater rights in the project area provided full coordination is implemented with the SEO and the BLM. Again, the total water demand of 886 ac-ft by the project would be spread out over several years and would not cause significant adverse impacts on the surface water or groundwater resources within the DFPA.

The analysis and discussion presented under the Proposed Action, Section 4.4.3.1, in regard to the discharge of hydrostatic test water, lining of reserve and evaporative pits, use of oil-based drilling muds, potential impacts on seeps and springs, compliance with “Onshore Order No. 2”, contamination of groundwater, impairment of surface water quality, destabilization of channels, and the management of produced water are applicable to this alternative.

4.4.3.3 Alternative B – No Action

Under the No Action Alternative, water resources would continue to be impacted at levels previously authorized for Mulligan Draw and Dripping Rock and as additional individual APD’s are granted by the BLM. Water resources impacts would be similar to those described above. In terms of magnitude, such impacts would likely be considerably less than for the Proposed Action.

4.4.4 Impacts Summary

Most adverse impacts to water resources would be avoided or reduced through implementation of control measures identified in Chapter 2 and mitigation measures listed in this section. The Proposed Action would result in a disturbance of 4,923 acres (approximately 2.1 percent of the DFPA) over a period of approximately 20 years. During the LOP (30-50 years), total disturbances would be reduced to approximately 2,139 acres (approximately 0.91 percent of the DFPA). Alternative A would result in a disturbance of 7,582 acres (approximately 3.2 percent of the DFPA) over a period of approximately 20 years. During the Alternative A LOP (30-50 years), total disturbances would be reduced to approximately 3,300 acres (approximately 1.40 percent of the DFPA). Alternative B - No action, under which individual APD’s could continue to be approved by the BLM, would result in impacts approaching the magnitude of the Proposed Action. However, there would be an increased probability of occurrence of unexpected adverse impacts since overall project development would not happen in a well-planned manner.

Impacts resulting from drill pad, access road, facility site, and pipeline ROW construction could include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, loss of topsoil productivity, and increased susceptibility of the soil to wind and water erosion. These impacts could increase runoff, erosion, and off-site sedimentation. Total erosion that could result from the proposed project after the first year of construction with effective erosion control would be approximately 9,711.1 tons for the Proposed Action and 14,950.8 tons for Alternative A. After five years, erosion levels would decrease to 1,999.2 tons and 3,076.7 tons, respectively, with erosion control. This erosion would be in addition to the natural baseline erosion as well as the erosion occurring due to existing disturbance in the DFPA. Although the majority of the project area is classified as sensitive soil and such areas cannot be totally avoided, particular attention would be given to avoiding steep slopes greater than 25 percent, badlands, sandy soils, and soils with high water tables and/or which are subject to inundation and thus, minimize the chance of a significant impact. These impacts could be kept to non-significant levels with application of the mitigation measures in Chapter 2 and the control measures recommended in Appendix C.

As identified previously, authorization of the Proposed Action would require full compliance with RMP management directives that relate to surface and groundwater protection, EO 11990 (floodplains protection), and the CWA in regard to protection of water quality and compliance with Section 404. These regulations require that certain permits/authorizations be obtained for project authorization including an NPDES permit; a surface runoff, erosion, and sedimentation control plan; an oil spill containment and contingency plan; and CWA Section 404 permits. Most of the ephemeral drainage channels identified on Figure 3-5 are classified as Waters of the U.S. and are often associated with jurisdictional wetlands. Crossings of these channels and associated wetlands would require authorization from the COE through the CWA Section 404 permitting process. However, these channel crossings would likely receive expedited authorization from the COE through General Permit 98-08. Other project facilities such as well sites and/or facilities sites could not be located in Waters of the U.S. and therefore, Section 404 permitting would not be necessary for such facilities. Each individual channel crossing would be reviewed during the APD/ROW permitting process for specific permit requirements under Section 404 of the CWA. No significant impacts would likely result given the assumptions and compliance with management direction identified previously.

The Operators propose to completely reclaim all disturbed areas not needed for production activities including: (1) pipeline ROW, (2) portion of road ROW not needed in the function of the road, and (3) the portion of the drill pad not needed during production. Reclamation would generally include: (1) complete cleanup of the disturbed areas; (2) restoration of the disturbed areas to the approximate ground contour that existed prior to construction; (3) ripping of disturbed areas to a depth of 12 to 18 inches; (4) replacement of topsoil over all disturbed areas; (5) seeding of reclaimed areas with the seed mixture prescribed in the Surface Use Plan or Plan of Development for the proposed Action; and (6) fertilizing, if considered necessary by the BLM officer.

4.4.5 Additional Mitigation Measures

With measures identified in Chapter 2, no additional mitigation measures for water resources are required.

4.4.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.4.3.

4.5 VEGETATION AND WETLANDS

4.5.1 Introduction

Direct impacts would include the short-term loss of vegetation (modification of structure, species composition, and areal extent of cover types) due to soil disturbance and grading activities. Indirect impacts would include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; exposure of soils to accelerated erosion; shifts in species composition and/or changes in vegetative density; reduction of wildlife habitat; and changes in visual aesthetics.

4.5.2 Impact Significance Criteria

The following criteria were used to determine the significance of construction and operation of the proposed project on vegetation resources within the DFPA. These criteria were developed based on management directives, professional judgement, involvement in other NEPA projects throughout the West, and state regulations (e.g., the Wyoming Noxious Weed Act).

C non-compliance with management directives for the RFO and RSFO administrative areas;

- removal of vegetation such that following reclamation, the disturbed area(s) would not have adequate cover (density) and species composition (diversity) to support pre-existing land uses, including wildlife habitat, within a period of five years for general vegetation types or within two years for riparian and wetland areas;

- unauthorized discharge of dredged and/or fill materials into or excavation of waters of the U.S., including special aquatic sites, wetlands, and other areas subject to the federal Clean Water Act, EO 11988 (flood plains) and EO 11990 (wetlands and riparian zones);

- reclamation is not accomplished in compliance with EO 13112 (Invasive Species);

- introduction and establishment of noxious or other undesirable invasive, non-native plant species to the degree that such establishment results in listed invasive, non-native species occupying any undisturbed rangeland outside of established disturbance areas or hampers successful revegetation of desirable species in disturbed areas;

- removal or disturbance of special status plants (or habitat judged important for survival) to the extent that such impact would threaten the viability of the local population and/or induce an upgrade in the federal, state, or resource area status.

4.5.3 Direct and Indirect Impacts

4.5.3.1 Proposed Action

Vegetation removal and soil handling associated with the construction and installation of well pads, pipelines, access roads, and other facilities as described in Chapter 2 would affect vegetation resources both directly and indirectly. Direct impacts would include the short-term loss of vegetation (modification of structure, species composition, and areal extent of cover types). Indirect impacts would include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; exposure of soils to accelerated erosion; shifts in species composition and/or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics.

The proposed action would have short-term surface disturbance of 4,923 acres (approximately 2.1 percent of the DFPA). During the LOP (30-50 years), total disturbances would be reduced to 2,139 acres or approximately 0.92 percent of the project area.

Assuming all locations are productive, the area of impact under the Proposed Action would be reduced (upon successful reclamation) to 2,139 acres. The likelihood of impact is greatest for the primary vegetation cover types of Wyoming big sagebrush, desert shrub, and basin exposed rock/soil types which occupies 83.8 percent of the project area. Except for habitats occupied by plant species of concern, clearing of upland cover types would not be significant because upland cover types are generally abundant and widely distributed throughout the region and/or have been previously impacted (e.g., disturbed land).

Construction activities, increased soil disturbance, and higher traffic volumes could spur the introduction and spread of undesirable and invasive, non-native species within the DFPA. Non-native species invasion and establishment has become an increasingly important result of previous and current disturbance in southwest Wyoming. The project area is relatively free of noxious and other unwanted invasive, non-native species. These species often out-compete desirable species, including species of concern, rendering an area less productive as a source of forage for livestock and wildlife. Additionally, sites dominated by invasive, non-native species often have a different visual character that may negatively contrast with surrounding undisturbed vegetation. However, with implementation of best management practices and proposed mitigation measures, including non-native species establishment and invasion monitoring and remediation, no significant impacts are anticipated.

Potential impacts to waters of the U.S., including wetlands and other special aquatic sites, could include clearing, excavating, filling, and grading. Such impacts would reduce the area and functional values offered by an affected cover type. Specific project impacts on waters of the U.S. cannot be accurately assessed since facility locations have not been identified. However, waters of the U.S. comprise less than one percent of the DFPA. Given this occurrence and distribution, well sites would be located to avoid wetlands. Road and pipeline facilities, however, might affect a small amount (estimated < 5 acres) of wetlands where such facilities cannot be located to avoid wetlands. Given implementation of mitigation measures, as well as compliance with the RMP, the CWA, and Executive Orders 11990 and 11989, the probability of significantly impacting waters of the U.S. is low. As such, no significant impacts are anticipated. Road and pipeline crossings would likely be authorized under COE Nationwide Permits 12 (pipelines) or 14 (roads) or under Wyoming General Permit (GP) 98-08, developed by the COE to be used statewide for all types of oil and gas activities related to both exploration and production (Johnson 2001). BLM has the authority under this general permit (but is not required) to determine if the permit is applicable to activities that are

under their jurisdiction. In some cases, GP 98-08 is more restrictive than Nationwide Permits 12 and 14 (e.g., advance notification required for any crossing that impacts more than 0.10 acre). BLM is allowed to approve any activity up to the full limit of GP 98-08. However, the permittee must send a Statement of Compliance to the COE documenting what was done within 30 days after completion for activities that impact over 0.10 acre. This topic is further addressed in the Mitigation discussion.

4.5.3.2 Alternative A

Under Alternative A, the DFPA would have a maximum of: 2,220 acres of new surface disturbance from well locations (including on-site gathering, measurement, and dehydration facilities); 833 miles (4,035 acres) of new roads or upgrades of existing roads, 555 miles (1,166 acres) of new pipeline- and approximately 161 acres of new surface disturbance from ancillary facilities (i.e., 6 compressor stations [24 acres], 2 gas processing plant [60 acres], 4 water evaporation ponds [16 acres], 3 disposal wells [21 acres], and 16 water wells [40 acres]). Total new short-term surface disturbance resulting from Alternative A would be 7,582 acres (approximately 3.2 percent of the project area).

During the life of the project (30-50 years), total disturbances would be reduced to 3,300 acres (516 acres associated with 361 wells having 1.43 acres of remaining disturbance per well site, 2,623 acres of roads and 161 acres of surface disturbance associated with ancillary facilities) or approximately 1.0 percent of the project area.

Larger acres of construction impacts would occur to all vegetation cover types, including wetlands and other special aquatic sites, under Alternative A. Production phase impacts would include well locations, compressor station, pipelines, and roads. As with the Proposed Action, the amount and duration of such impacts would depend on the locations of the wells and access roads. The likelihood of impact is still greatest for the primary vegetation cover types of Wyoming big sagebrush, desert shrub, and basin exposed rock/soil types which occupy 83.8 percent of the DFPA.

Impacts would likely be higher under Alternative A than for the Proposed Action given the greater area of land that would be affected. The stipulations prescribed in the Great Divide RMP (USDI-BLM 1990a), Green River RMP (USDI-BLM 1997), and measures committed to by the Operators (Chapter 2) would preclude significant impacts to vegetative resources for reasons identified previously.

4.5.3.3 Alternative B - No Action

Under the No Action Alternative, vegetation would continue to be impacted at levels previously authorized for Mulligan Draw and Dripping Rock and as individual APD's are granted by the BLM. Loss of upland cover types would not be significant. If present, impacts to wetlands would be assessed and mitigated on a case-by-case basis similar to the action alternatives. Rare plant surveys would continue to be performed prior to surface disturbance activities associated with individual projects. Invasive, non-native species programs would be implemented per stipulations in individual APD's.

4.5.4 Impacts Summary

Implementation of the Proposed Action would initially affect 4,923 acres (2.1 percent of the project

area) of various vegetation cover types, during project construction. Reclamation efforts during well production would reduce impacts to 2,139 acres or 0.92 percent of the project area.

Impacts to vegetation would include removal of cover types (potential to decrease diversity and density of desirable species) and the increased potential for noxious weed invasion and establishment. Associated effects of such loss on wildlife, visual resources, and land use are discussed under those headings. Except for waters of the U.S. (including wetlands and other special aquatic sites) and/or plant species of concern and their habitat, a reduction in vegetation density would not be significant because upland vegetation types are relatively common, cover large areas, have wide distribution, and occur with high frequency within the project area as well as on other lands within the Washakie Basin. (See cumulative impacts for a discussion on the impact to vegetation cover types relative to existing disturbance in the DFPA and to projects within this larger context area.)

Monitoring for, and establishment of, invasive, non-native species and prompt and aggressive remediation, as provided for in Chapter 2, would prevent further invasive, non-native species invasion/establishment problems and facilitate successful revegetation of disturbed areas.

Project implementation could potentially impact the area and functions of wetlands, special aquatic sites, and other waters of the U.S. Direct impacts could occur through filling, grading, and excavation; indirect impacts could occur through hydrologic modification, sedimentation, pollution, and disturbance. Due to the larger area of disturbance associated with road/pipeline ROW facilities, Alternative A would be more likely to affect waters of the U.S. than the other alternatives. However, measures imposed by the RMP (USDI-BLM 1990a) and 404 permitting process would prevent or avoid impacts to jurisdictional wetlands and other special aquatic sites. Further, compliance with Section 404(b)(1) guidelines would remove the potential for significant impacts under all alternatives.

All alternatives have potential to affect plant species of concern or habitat for such species. However, given implementation of Chapter 2 measures, no significant impacts are anticipated. No listed plant species or species proposed for listing under the ESA would be impacted as none occur in the project area.

The duration and magnitude of impacts to vegetation cover types would depend on the locations of well sites and access roads, the success of mitigation and revegetation efforts. It is not realistic to consider that sites would be returned to predisturbance conditions in terms of diversity but can meet predisturbance cover and production. In terms of successful site stabilization, necessary time should be on the magnitude of 3-5 years. Revegetation success would depend on the amount and quality of topsoil salvaged, length of time stockpiled, and respread depth over disturbed areas, as well as seed quality and post-seeding invasive, non-native species control efforts.

Reclamation would be accomplished according to a site-specific reclamation and revegetation plan that uses best-management practices. Revegetation would involve the use of plant materials that meet specific reclamation objectives in terms of soil erosion control; soil protection, stabilization, and fertilization; aesthetics; and compatibility with native vegetation adjacent to the disturbance area. Native species would be utilized according to BLM policy. In spite of the poor to fair reclamation potential for many soils (see discussion under Soils, Section 3.5), technology exists to stabilize sites and return disturbed areas to predisturbance cover and production conditions in the time frame indicated by the significance criteria.

4.5.5 Additional Mitigation Measures

With measures identified in Chapter 2, no additional mitigation measures are required.

4.5.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required.

4.6 RANGE RESOURCES AND OTHER LAND USES

4.6.1 Introduction

Impacts to range resources and other land use would result from Proposed Action-related activities, traffic, and the disturbance of soils and vegetation during drilling and construction of access roads, gathering lines and ancillary facilities.

4.6.2 Impact Significance Criteria

Impacts to range resources and other land use would be significant if Proposed Action-related activities were not in compliance with the management objectives outlined in the Great Divide RMP (USDI-BLM 1987, 1988a, and 1990a) and the Green River RMP (USDI-BLM 1992a, 1996a, and 1997).

- To enhance livestock grazing while maintaining a balance between economic uses and the enhancement of wildlife habitat, watershed, and riparian areas, and while maintaining or improving range conditions over the long term (Great Divide RMP).

- To improve forage production and ecological conditions for the benefit of livestock use, wildlife habitat, watershed, and riparian areas; maintain, improve or restore riparian habitat to enhance forage conditions, wildlife habitat, and stream quality: and to achieve proper functioning condition or better on 75 percent of riparian areas (Green River RMP).

- To support the goals and objectives of other resource programs for managing the BLM administered public lands and to respond to public demand for land use authorizations.(Great Divide RMP).

- To manage the public lands to support the goals and objectives of other resource programs, to respond to public demand for land use authorizations, and to acquire administrative and public access where necessary (Green River RMP).

4.6.3 Direct and Indirect Impacts

The DFPA includes land that is located within 13 BLM grazing allotments (described in Section 3.6). Under all alternatives, livestock grazing activities would continue in these allotments during all phases of gas development. Forage would be reduced during drilling and field development and restored as soon as practical thereafter (Section 2.5.2.10), except for areas used for roads,

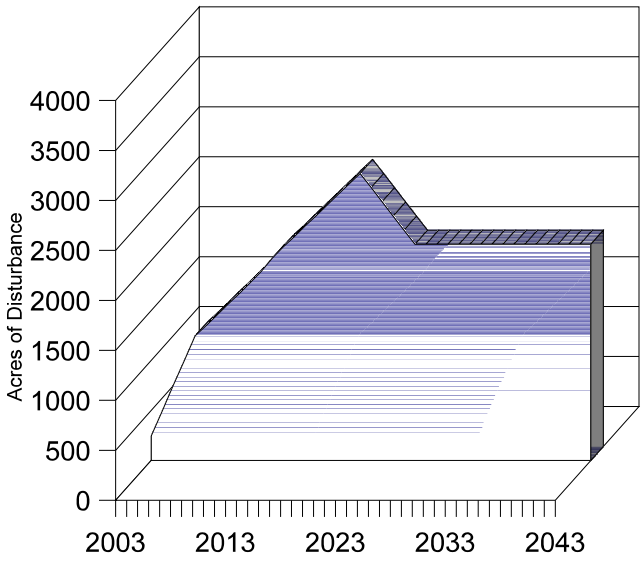
production equipment and ancillary facilities, which would remain disturbed throughout the productive life of the field.

4.6.3.1 Proposed Action

The Proposed Action would result in an estimated 4,923 total acres of short-term disturbance during drilling and field development, including a total of 2,624 acres disturbed for new or upgraded access roads and two-tracks, 758 acres disturbed for pipeline construction, 1,444 acres disturbed for drill pads and 97 acres disturbed for ancillary facilities. However, only a portion of this total would be disturbed at any one time during the 20-year drilling and field development cycle. Drill pads and roads associated with dry holes and unused portions of productive well pads would be reclaimed to the approximate land form that existed prior to construction. If drilling is productive, all access roads to the well site would remain in place for well servicing activities (i.e., maintenance, improvements, etc.). Partial reclamation would be completed on segments of the well pad and access road ROW no longer needed. All areas disturbed for gas and produced water pipelines would also be reclaimed.

Based on the assumption that reclaimed areas would be suitable for grazing five years after reclamation, total disturbance would begin at 247 acres in 2003, increase to a peak of 2,871 acres in 2022, then decrease to a constant 2,139 acres from 2027 through 2042, the remainder of the analysis period (Figure 4-6).

Figure 4-6. Total Disturbance: Proposed Action



Source: Blankenship Consulting LLC

Long term disturbance would include 1,706 acres of new roads, which would be used to access wells and ancillary facilities during operations, 336 acres of the DFPA disturbed for drill

pads and 97 acres for ancillary facilities. All remaining disturbed areas would be reclaimed at the end of field operations, except those facilities which the BLM may identify as desirable for other use.

The average stocking rate for the RFO grazing allotments affected by the Proposed Action is 12 acres per AUM; the average for the Rock Springs Grazing allotment is about 9 acres per AUM. Consequently, the Proposed Action would result in an average annual loss of forage to support 158 AUM's in the RFO portion of the DFPA and 12 AUM's in the RSFO portion. These losses would total 6,796 AUM's for both areas over the 40 year LOP. Average annual losses of AUM's in the RFO portion of the DFPA would amount to substantially less than one percent of the total AUM's permitted on the 12 allotments. The portion of the RSFO-administered allotment (the Rock Springs allotment) that lies within the DFPA receives little or no use because of terrain and access considerations, so temporary loss of forage in that area would not be likely to impact grazing levels in that allotment. The estimated average annual loss of 12 AUM's would represent a negligible portion of the over 100,000 AUM's permitted for the Rock Springs Allotment. Estimated economic effects of these reductions are discussed in Section 4.12.3.1.2.

The Proposed Action-related increase in traffic in the DFPA, particularly during the drilling and field development phase, would correspondingly increase the potential for vehicle/livestock accidents during that period. The potential for vehicle/livestock accidents is particularly high in areas where calves and lambs are present, and on roads on ridge lines, flats and other open areas that attract trailing bands of sheep and wintering sheep. Given the low traffic volumes associated with field operations, vehicle/livestock collisions are of less concern for the long term.

There is also potential for damage to BLM and livestock operator fences, gates and cattle guards from the movement of trucks, drilling rigs and heavy equipment and for the scattering of livestock off allotments from gates being left open. Unless gates are promptly repaired to appropriate standards, livestock may scatter off the allotment. Scattering of livestock results in additional costs for grazing permittees for locating and moving livestock and potential damage to the range outside of authorized allotments. In areas bordering the Adobe Town Wild Horse Management Area, open gates can result in wild horses entering grazing allotments, resulting in additional round-up costs for the BLM and loss of forage and increased maintenance costs for livestock operators (Otto 2002).

Disturbance of soil and the movement of vehicles would increase the potential for introduction and spreading of invasive, non-native species into the relatively weed-free portions of the DFPA. Potential invasive, non-native species impacts are discussed in Section 4.5.3.1.

As described in Section 3.6, other land use on and adjacent to the proposed action includes wildlife habitat, dispersed outdoor recreation and oil and gas exploration, development, and transportation. Effects on wildlife resources are described in Section 4.7. Effects on recreation resources are described in Section 4.9. Although there is some potential for drilling and field development activities to encroach on existing oil and gas leases, ROW's, and facilities, the preconstruction planning and site layout process described in Section 2.5.1 would minimize this potential.

Based on the assumptions and estimates contained in this assessment, and with the mitigation measures outlined in Sections 2.5.2.11.2 and 4.6.5, Proposed Action-related drilling and field development activities would not result in significant impacts to range resources or other land use.

4.6.3.2 Alternative A

Implementation of Alternative A would increase disturbances by about 55 percent over those associated with the Proposed Action, on an average annual basis. Loss of forage associated with Alternative A would result in an average loss of 248 AUM's annually from the RFO portion of the DFPA and 18 AUM's from the RSFO portion. These losses would represent substantially less than one percent in either portion.

Opportunities for vehicle/livestock collisions and the damaging of livestock control structures would be substantially increased under this alternative based on the increase in traffic and activity in the DFPA. Opportunities for introduction of invasive, non-native species and the potential for encroachment on other leases and ROW's would also be increased.

Successful implementation of the mitigation measures outlined in Sections 2.5.2.11.2 and 4.6.5 would prevent significant impacts to range resources or other land use under Alternative A.

4.6.3.3 Alternative B - No Action

Under Alternative B, development in the DFPA would include the previously approved decisions for the Mulligan Draw and the Dripping Rock/Cedar Breaks areas as well as other development approved on a case-by-case basis by the BLM. Range resources impacts would be similar to those described above. In terms of magnitude, such impacts would likely be significantly less than for the Proposed Action.

The potential for vehicle/livestock collisions and damage to livestock control structures would depend on the number of wells ultimately approved under the No Action Alternative, as would the potential for the introduction of invasive, non-native species and encroachments on other leases and ROW's. In any case, these impacts are not anticipated to be significant.

4.6.4 Impacts Summary

Range and other land use impacts associated with all three alternatives would include disturbed land and associated loss of AUM's, which would average about 170 AUM's annually for the Proposed Action, 248 annually for Alternative A and an unknown amount for Alternative B (No Action) depending on the number of wells ultimately approved by the BLM (Mulligan Draw and Dripping Rock/Cedar Breaks areas, plus wells in other portions of the DFPA approved on a case-by-case basis).

The potential for vehicle livestock collisions, damage to livestock control structures, introduction of invasive, non-native species and encroachments on other leases and ROW's is greater under Alternative A than under the Proposed Action, given the 54 percent increase in wells and associated traffic and activity. The potential for these impacts would be considerably less under Alternative B, unless the ultimate number of wells approved approached that of the Proposed Action.

4.6.5 Additional Mitigation Measures

With implementation of mitigation measures proposed in Section 2.5.2.11.2, no additional mitigation measures are required.

4.6.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.6.3.

4.7 WILDLIFE

4.7.1 Introduction

The principal wildlife impacts likely to be associated with the Proposed Action or alternatives include: (1) a direct loss of certain wildlife habitat, (2) the displacement of some wildlife species, (3) an increase in the potential for collisions between wildlife and motor vehicles, and (4) an increase in the potential for the illegal kill and harassment of wildlife.

4.7.1.1 Analysis Approach

A total of 361 well locations are proposed under the Proposed Action for the 233,542-acre project area. Long-term disturbance, as a result of the Proposed Action, totals 2,139 acres and would result in disturbance of 0.9% of the DFPA. Well locations are not known at this time, and would likely be concentrated within and near existing gas fields. Therefore, an analysis of potential wildlife impacts within each section in the DFPA was made so that operators could take the locations of these potential impacts into account when planning and selecting eventual well locations.

A maximum of 4 well locations would be developed within any given section except those where such development would produce unacceptable levels of wildlife impacts. Mitigation measures that correspond to the respective types of wildlife impacts within any given section would be implemented.

Based on existing data sources, the primary wildlife resource concerns known to be present within each section of the DFPA were mapped (HWA 2002). These resource concerns include: big game (elk, mule deer, pronghorn) crucial winter ranges; overlapping big game crucial winter ranges (multiple species); leks, nesting habitat, and severe winter relief habitat of greater sage-grouse; raptor nests; potential mountain plover habitat; and white-tailed prairie dog colonies. This approach facilitated the construction of a map showing the combinations of wildlife resources within each section that may require mitigation, and areas where those resource concerns overlap (Figure 4-7; Appendix G).

The wildlife map represents the currently known locations of wildlife resource concerns within the DFPA. As more field data is gathered, additional areas that include wildlife resource concerns may be identified and mapped. Every combination of wildlife resource concerns within each section of the DFPA is described and listed in Appendix G. If development occurs in areas of overlapping wildlife resource concerns, mitigation measures for each individual resource would be implemented. Mitigation measures for wildlife species are summarized in Sections 2.5.2.11.2, 4.7.6, 4.8.1.4, and 4.8.2.3. This approach provides the operators with beneficial information that can be utilized when developing gas well placement plans. Planned placement of disturbances may be used to avoid individual wildlife resource concerns, or overlapping concerns present within a section. All appropriate mitigation measures for the corresponding wildlife resources that are disturbed within a section would be implemented.

The potential impacts upon individual species and the primary resources that overlap those species are discussed in the Direct and Indirect Impacts Sections. Summaries of combinations of wildlife concerns, and overlapping wildlife resources are presented in Sections 4.7.3.1.6, 4.8.1.2.1, and 4.8.1.2.2. Detailed analyses of overlapping wildlife resources are presented in the Wildlife and Fisheries Technical Report for this project (HWA 2002).

4.7.2 Impact Significance Criteria

The following criteria were considered in the assessment of impacts associated with the Proposed Action and alternatives:

- Whether or not the action would result in non-compliance with existing BLM (USDI-BLM 1988a, 1990a, USDI-BLM 1996a, 1997), FWS, or WGFD management objectives for wildlife, or BLM wildlife stipulations for surface occupancy criteria on natural gas mineral developments.

- Whether or not a substantial increase in direct mortality of wildlife due to road kills, harassment, or other causes would occur.

- Whether or not an officially-designated crucial wildlife habitat was eliminated, sustained a permanent reduction in size, or was otherwise rendered unsuitable.

- Whether or not any effect, direct or indirect, results in a long-term decline in recruitment and/or survival of a wildlife population.

- Disruption of greater sage-grouse, or raptor breeding or nesting activities to the extent that reproductive success is threatened or damaged.

4.7.3 Direct and Indirect Impacts

Wildlife habitats directly affected by the proposed project include areas which are physically disturbed by the construction of wells, roads, pipelines, and production facilities; wildlife habitats indirectly impacted include areas surrounding directly impacted habitats. Disturbance during construction and production such as human presence and noise may displace or preclude wildlife use of these areas. Wildlife sensitivity to these potential indirect impacts varies considerably with each animal species. Potential direct and indirect impacts to wildlife species are discussed in the following sections. The Wildlife Monitoring/Protection Plan (Appendix H) would be used to detect any potential unanticipated impacts to wildlife and fish species throughout the LOP.

4.7.3.1 Proposed Action

As described in detail in Section 2.2, a total of 385 new natural gas wells at 361 well locations would be drilled and developed under this alternative during the next 20 years with an expected LOP of 30-50 years. Well placement within the DFPA is not known at this time, therefore it was assumed that any section may potentially be developed.

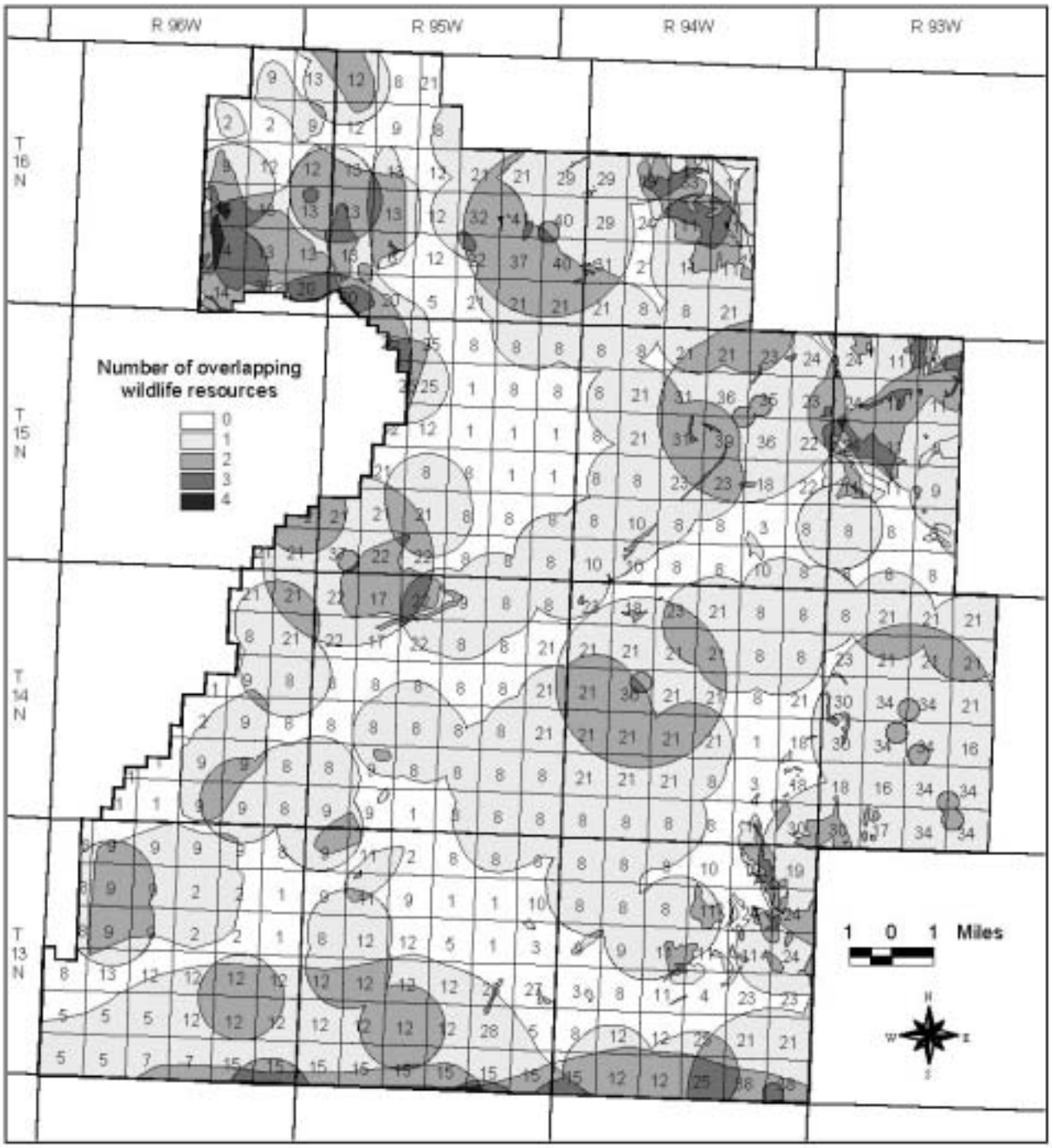


Figure 4-7. Locations and types of wildlife resources that could potentially be impacted within each section of the DFPA. Numbers in sections are resource codes listed in Appendix G and describe the combinations of wildlife resources present. The physical distribution and overlap of wildlife resources is depicted by levels of shading. Wildlife resources include: big game (elk, mule deer, pronghorn) crucial winter range; greater sage grouse leks (1/4 mi. buffer), nesting habitat (2-mile buffer around leks), and severe winter relief habitat; potential mountain plover habitat; raptor nest 1-mile buffers; and prairie dog colonies.

Development at this level would disturb approximately 4,923 acres of wildlife habitat over the next twenty-years. However, reclamation of disturbed habitats would commence immediately and continue throughout the 20-year construction period, resulting in a total un-reclaimed disturbance area at any given point in time that would never equal the sequential total of 4,923 acres. Reclamation of disturbed areas along pipelines, road ROW's, and unused portions of well pads would result in re-establishment of vegetation in these areas, in a relatively short time period. Re-vegetation would continue with the subsequent reclamation of abandoned well sites. This reclamation would reduce the area disturbed by the Proposed Action by 56.6 percent, to 2,139 acres (this assumes a 65% drilling success rate with roads to unsuccessful wells being reclaimed). Grasses and forbs are expected to become established within the first several years following reclamation, however an estimated 8 to 15 years would be required for shrub re-establishment. Consequently, the removal of shrub habitat within the project area would represent a longer-term loss to those species that depend on such vegetation for forage or shelter.

In addition to the direct loss of habitat due to construction of well pads and associated roads and pipelines, disturbances from human activity and traffic may lower the utilization of habitat immediately adjacent to these areas. Habitat effectiveness of these areas would be lowest during the construction phase when human activities are more chronic and localized. During the production phase of operations, many animals would likely become accustomed to equipment and facilities and once again resume using habitats immediately adjacent to these areas.

4.7.3.1.1 General Wildlife

The disturbance of 4,923 acres of wildlife habitat would reduce habitat availability for a variety of common small birds and mammals. The temporary disturbances that occur during the 20-year construction period would tend to favor early succession wildlife species such as ground squirrels and horned larks and would have more impact on mid-to-late-succession species such as sage sparrows, sage thrashers, and voles. The long-term disturbance of 2,139 acres would have a low effect on common wildlife species. The primary non-game songbirds that may be affected by the reduction in habitat would be horned larks, sage sparrows, sage thrashers, and vesper sparrows. Although there is no way to accurately quantify these changes, the impact is likely to be low in the short term and be reduced over time as reclaimed areas begin to provide suitable habitats. Because of the high reproductive potential of these species they would rapidly repopulate reclaimed areas as habitats become suitable. Birds are highly mobile and would disperse into surrounding areas and utilize suitable habitats to the extent that they are available.

The primary small mammals found on the project area include, but are not limited to, desert cottontail, deer mice, least chipmunks, mountain cottontail, and golden-mantled ground squirrels. The initial phases of surface disturbance would result in some direct mortality and displacement of small mammals from construction sites. Quantifying these changes is not possible because population data are lacking. However, the impact is likely to be low, and the high reproductive potential of these small mammals would enable populations to quickly repopulate the area once reclamation efforts are initiated.

4.7.3.1.2 Big Game

Impacts to big game species include the removal of habitat; displacement due to increased human activities; increased potential for vehicular collisions due to new roads and increased traffic levels on existing roads; and increased potential for poaching due to easier access and increased human

activities. The disturbance to big game species depends on the seasonal use of the area by each species and the corresponding drilling schedule. Also, displacement due to human disturbance would be more pronounced in the short term, and the magnitude depends on the ability of a species to habituate to disturbance. Potential impact summaries and disturbance responses for each big game species are presented below.

Pronghorn Antelope

The 13,612 acres of pronghorn crucial winter/yearlong range are located within 46 sections of the DFPA (Figure 3-10; Appendix G). These sections are located in the northwest corner and southern edge of the DFPA. Portions of 14 of these sections are located within the MVMA. The remainder of the DFPA (219,930 acres) is classified as winter/yearlong range. Pronghorn crucial winter/yearlong range was overlapped most often with raptor nest buffer areas (4,492 acres), followed by potential mountain plover habitat (2,400 acres) (HWA 2002). Significant impacts in these areas of overlapping resources are not expected if the mitigation measures for each of these individual resources are implemented.

Development of the maximum 4 well locations within a section composed entirely of pronghorn crucial winter range would remove approximately 54.5 acres, or 8.5%, of the habitat in that section. The WGFD classifies big game crucial winter habitats as vital and recommends that habitat function be maintained so that the location, essential features, and species supported by the habitat are unchanged (WGFD 2000b). Not all habitat within designated crucial winter range is of equal quality. Areas with higher quantity and quality of forage and areas that provide cover from extreme winter weather conditions provide the best quality crucial winter range habitat. Avoidance of these areas, as identified by the BLM, on a case-by-case basis, would reduce impacts to pronghorn crucial winter range habitat. Reclamation of well pads, pipelines, and ROW's would provide grass forage within a few years, while sagebrush and other shrub species important as winter forage would require longer for re-establishment (approximately 8 to 15 years). Disturbance of seasonal pronghorn ranges within the DFPA is not likely to reduce pronghorn carrying capacity within the Bitter Creek Herd Unit. Several general pronghorn migration routes transverse the DFPA, but these routes are not expected to be impacted because no linear barriers such as fences would be constructed.

In addition to the direct removal of habitat due to the development of wells and associated transportation facilities, disturbances from drilling activities and traffic would affect utilization of the habitat immediately adjacent to these areas. However, pronghorn have been found to habituate to increased traffic volumes and heavy machinery as long as the machines move in a predictable manner (Reeve 1984). Pronghorn have also been found to habituate to and inhabit surface mining sites in Wyoming (Segerstrom 1982, Deblinger 1988). Well development operations and deviation from ordinary activities may cause limited antelope displacement of up to 0.5 miles (Segerstrom 1982), but they would likely habituate to activities along roads and continue using habitats in those areas (Reeve 1984). The magnitude of displacement would decrease over time as: (1) the animals have more time to adjust to the circumstance, and (2) the extent of the most intensive activities such as drilling and road building diminishes and more wells are put into production. By the time the field is under full production, construction activities will have ceased, and traffic and human activities in general would be greatly reduced. As a result, this impact would be minimal and it is unlikely that pronghorn would be significantly displaced under full field development. The level of pronghorn use of the area is more likely to be determined by the quantity and quality of forage available. Restricting construction activities and vehicle traffic within pronghorn crucial

winter/yearlong range from November 15 to April 30, in accordance with BLM stipulations, would minimize the probability of adverse impacts from displacement during this critical time of the year, and long-term adverse effects are not expected.

The potential for vehicle collisions with pronghorn would increase as a result of increased vehicular traffic associated with the presence of construction crews and would continue (although at a reduced rate) throughout all phases of the well operations. Requiring regular drivers to undergo training and education is expected to reduce the incidence of vehicle collision impacts to pronghorn to low levels and no long-term adverse effects are expected. Development of new roads would allow greater access to more areas and may lead to an increased potential for poaching of big game animals. The application of mitigation described in Section 2.5.2.11.2 and 4.7.6 would minimize impacts, and long-term adverse effects to pronghorn are not expected.

Mule Deer

The 19,430 acres of mule deer crucial winter/yearlong range are located within 42 sections of the DFPA (Figure 3-11; Appendix G). Mule deer crucial winter/yearlong range is located in the extreme northern and southwestern portions of the DFPA. Three of these sections are located within the MVMA. The remainder of the DFPA (214,112 acres) is classified as winter/yearlong range. Mule deer crucial winter/yearlong range was overlapped most often by raptor nest buffer areas (5,867 acres), followed by elk crucial winter/yearlong range (1,458 acres) (HWA 2002). Significant impacts in these areas of overlapping resources are not expected if the mitigation measures for each of these individual resources are implemented.

Development of the maximum 4 well locations within a section composed entirely of mule deer crucial winter range would remove approximately 54.5 acres, or 8.5%, of the habitat in that section. The WGFD classifies big game crucial winter habitats as vital and recommends that habitat function be maintained so that the location, essential features, and species supported by the habitat are unchanged (WGFD 2000b). Not all habitat within designated crucial winter range is of equal quality. Areas with higher quantity and quality of forage and areas that provide cover from extreme winter weather conditions provide higher quality crucial winter range habitat. Avoidance of these areas, as identified by the BLM, on a case-by-case basis, would reduce impacts to mule deer crucial winter range habitat. Reclamation of the well pads and ROW's would provide grass forage within a few years, while mountain mahogany, big sagebrush, and other shrub species important as forage for mule deer would require a longer time period for re-establishment (approximately 8 to 15 years). Disturbance of seasonal mule deer ranges within the DFPA is not likely to reduce mule deer carrying capacity within the Baggs Herd Unit. Several general mule deer migration routes transverse the DFPA, but these routes are not expected to be impacted because no linear barriers such as fences would be constructed.

In addition to the direct removal of habitat due to the development of wells and associated transportation facilities, disturbances from drilling activities and traffic would affect utilization of the habitat immediately adjacent to these areas. Mule deer, however, are adaptable and may adjust to non-threatening, predictable human activity (Irby et al. 1988, Gusey 1986). During a three-year study of response of pronghorn and mule deer to petroleum development on crucial winter range in central Wyoming, Easterly et al. (1991) found that mule deer "did not avoid oil fields" and that "deer did not move significant distances from the well site after the start of drilling activity." Similarly, in an assessment of the effects of winter 3D seismic operations on mule deer in western Wyoming, Hayden-Wing Associates (1994) found that although deer avoided areas of major

seismic activities, they quickly moved back onto such areas following completion of work. Furthermore, the deer were not displaced long distances and remained immediately adjacent to active seismic operations. Although seismic activities were seen to displace mule deer, there was no evidence that such displacement caused undo stress or negative effects. Most deer responses consisted of avoidance of areas proximal to the operations and deer carried out normal activities of feeding and bedding within 1/8 to ½ mile of most active seismic operations (Hayden-Wing Associates 1994).

The magnitude of displacement would decrease over time as: (1) the animals have more time to adjust to the circumstance, and (2) the extent of the most intensive activities such as drilling and road building diminishes and more wells are put into production. By the time the field is under full production, construction activities will have ceased, and traffic and human activities in general would be greatly reduced. As a result, this impact would be minimal and it is unlikely that mule deer would be significantly displaced under full field development. The level of mule deer use of the area is more likely to be determined by the quantity and quality of forage available. Restricting construction activities and vehicle traffic (through road closures) within mule deer crucial winter/yearlong range from November 15 to April 30, in accordance with BLM stipulations, would minimize the probability of adverse impacts from displacement during this critical time of the year, and long-term adverse effects are not expected.

The potential for vehicle collisions with mule deer would increase as a result of increased vehicular traffic associated with the presence of construction crews and would continue (although at a reduced rate) throughout all phases of the well operations. Requiring regular drivers to undergo training and education is expected to reduce the incidence of vehicle collision impacts to mule deer to low levels and no long-term adverse effects are expected. Development of new roads would allow greater access to more areas and may lead to an increased potential for poaching of big game animals. The application of mitigation described in Sections 2.5.2.11.2 and 4.7.6 would minimize impacts, and long-term adverse effects to mule deer are not expected.

White-tailed Deer

Because of the very limited habitats suitable for white-tailed deer on the project area, use by this species is unlikely to occur very often, if at all, and impacts to white-tailed deer are not expected.

Elk

The 1,873 acres of elk crucial winter/yearlong range are located within 10 sections in the extreme southern portion of the DFPA (Figure 3-12; Appendix G). None of these sections are located within the MVMA. The remainder of the designated elk seasonal ranges within the DFPA consist of winter/yearlong (21,302 acres) and yearlong (9,364 acres) ranges. Approximately 201,003 acres or 86.1% of the project area is not designated as an elk seasonal range. Elk crucial winter/yearlong range was overlapped most often with mule deer crucial winter/yearlong range (1,458 acres), followed by raptor nest buffer areas and mule deer crucial winter/yearlong range (361 acres) (HWA 2002). Significant impacts in these areas of overlapping resources are not expected if the mitigation measures for each of these individual resources are implemented.

Development of 4 well locations within a section entirely composed of elk crucial winter range would remove approximately 54.5 acres, or 8.5%, of the habitat in that section. The WGFD classifies big game crucial winter habitats as vital and recommends that habitat function be maintained so that

the location, essential features, and species supported by the habitat are unchanged (WGFD 2000b). Not all habitat within designated crucial winter range is of equal quality. Avoidance of those areas that provide the best quality crucial winter range habitat, as identified by the BLM, on a case-by-case basis, would reduce impacts to elk crucial winter range habitat. Reclamation of the well pads and ROW's would provide grass forage within a few years, while mountain mahogany, big sagebrush, and other shrub species would require longer for re-establishment (approximately 8 to 15 years). Disturbance of seasonal elk ranges within the DFPA is not likely to reduce elk carrying capacity within the Petition Herd Unit. No elk migration routes have been determined to transverse the DFPA, however, elk from the Powder Rim, on the southern edge of the DFPA, do migrate east to the Sierra Madre and Elk Head mountains in the summer (Porter 1999). Potential elk migration routes are not expected to be impacted because no linear barriers such as fences would be constructed.

In addition to the direct removal of habitat due to the development of wells and associated transportation facilities, disturbances from drilling activities and traffic would affect utilization of the habitat immediately adjacent to these areas. Elk are more sensitive to human activities than pronghorn or mule deer, and they may be displaced from well construction areas by 0.75 - 2 miles (Brekke 1988, Gusey 1986, Hiatt and Baker 1981). Displacement would be reduced in areas with topographic barriers (Edge and Marcum 1991). Elk would likely habituate to the physical presence of gas wells and predictable, non-threatening traffic movement associated with well maintenance (Ward et al. 1973, Ward 1976, Hiatt and Baker 1981, Perry and Overly 1976). Only localized, short-term displacement of elk during the development phase of the project is expected to occur in those areas that are designated as elk seasonal ranges.

The magnitude of displacement would decrease over time as: (1) the animals have more time to adjust to the circumstance, and (2) the extent of the most intensive activities such as drilling and road building diminishes and more wells are put into production. By the time the field is under full production, construction activities will have ceased, and traffic and human activities in general would be greatly reduced. As a result, this impact would be minimal and it is unlikely that elk would be significantly displaced under full field development. The level of elk use of the area is more likely to be determined by the quantity and quality of forage available. Restricting construction activities and vehicle traffic (through road closures) within elk crucial winter/yearlong range from November 15 to April 30, in accordance with BLM stipulations, would minimize the probability of adverse impacts from displacement during this critical time of the year, and long-term adverse effects are not expected.

The potential for vehicle collisions with elk would increase as a result of increased vehicular traffic associated with the presence of construction crews and would continue (although at a reduced rate) throughout all phases of the well operations. Requiring regular drivers to undergo training and education is expected to reduce the incidence of vehicle collision impacts to elk to low levels and no long-term adverse effects are expected. Development of new roads would allow greater access to more areas and may lead to an increased potential for poaching of big game animals. The application of mitigation described in Sections 2.5.2.11.2 and 4.7.6 would minimize impacts, and long-term adverse effects to elk are not expected.

Overlapping Big Game Crucial Winter Range

Areas of overlapping big game crucial winter range are of greater importance because they provide crucial habitat for more than one species of big game. There are several small areas of overlapping big game crucial winter range located in 11 sections on the Powder Rim along the southern edge of the DFPA (Figure 4-7). The combinations of overlapping big game crucial winter ranges include the following: elk/mule deer 1,931 acres; mule deer/antelope 733 acres; elk/antelope 111 acres; elk/mule deer/antelope 111 acres (HWA 2002). The impacts of habitat loss within overlapping crucial winter ranges would be greater than in non-overlapping areas. The Great Divide RMP (USDI-BLM 1990a) states that habitat quality will be maintained within areas of overlapping big game crucial winter ranges. Therefore, in areas where overlapping crucial winter ranges would be disturbed, steps to reduce disturbance, such as a reduction in the number of well locations allowed per section to less than 4, would reduce impacts. This may require directional drilling of wells to limit disturbance. If overlapping big game crucial winter range habitat is disturbed, further measures such as vegetation enhancement in adjacent areas may be implemented, if deemed appropriate by the BLM, in order to compensate for loss of forage in the area.

4.7.3.1.3 Wild Horses

The majority of the DFPA lies within the bounds of the Adobe Town Wild Horse HMA. Within the project area, 194,105 acres (83.1 percent) are classified as part of the Wild Horse HMA and an additional 37,976 acres (16.3 percent) not within the Wild Horse HMA are used by wild horses during some portion of the year (USDI-BLM 1999d). In the following discussion this area is referred to as “other wild horse habitat”. Surface disturbances associated with the initial installation of gas wells, roads, pipelines, and ancillary facilities would impact some of these habitats. The majority of sections (334 out of 377, or 89%) within the DFPA and all sections within the MVMA are included within the Adobe Town Wild Horse HMA (Figure 3-13).

Development of 4 well locations per section would result in loss of forage, and exploration and development activities within the DFPA may cause temporary displacement of horse bands from range adjacent to developing well sites, to other range in the Adobe Town Wild Horse HMA. The disturbance and displacement would be a short-term, local impact on individual horses that use areas where well pads are being developed. Increased human activity over the long-term may potentially influence the “wild” behavior of horses as they become more acclimated to human presence and activity. At this time it is not known what impacts the long-term activity within a natural gas field may have upon the behavioral patterns of wild horses. The short-term displacement of some horses utilizing areas near wells pads or roads may result in increased pressure on sensitive resource areas such as springs and water holes. However, development may create areas such as water impoundments and vegetation on reclamation areas that horses are attracted to. In these instances, horse use of naturally occurring sensitive areas such as springs may be reduced. Post-reclamation disturbance would be reduced to approximately 2,139 acres within the DFPA. On-going project activities on these 2,139 acres would remain throughout the 30 to 50-year life of production for the gas field. Implementation of the Proposed Action is not expected to significantly impact wild horses within the DFPA.

4.7.3.1.4 Upland Game Birds

Greater Sage-grouse. Six leks that were active during 2000 surveys are located on and within 2 miles of the DFPA (Figure 4-8). According to BLM and WGFD historical records, ten additional leks have been documented that were not active during the surveys of 2000 (Figure 4-8). For the purpose of this analysis, all leks on and within two miles of the DFPA are considered active until such time as a determination can be made through field monitoring, that the leks are historic. Historic leks are those that have not been used in the past 7-10 years. Eleven greater sage-grouse leks are located within the DFPA. The 0.25 mile buffers around those leks total1,362 acres and collectively occupy portions of 20 sections. Five leks are located within the 2-mile buffer of the DFPA. No leks are located within the MVMA portion of the DFPA.

Breeding. Noise related to drilling and production activities may affect greater sage-grouse utilization of leks or reproductive success. Reduction of noise levels in areas near leks would minimize this potential impact. Surface disturbance would be avoided within 0.25 miles of leks unless they are considered historic. However, the BLM in consultation with the WGFD, may grant linear disturbance (e.g. pipelines, seismic activity) exceptions that do not result in permanent habitat loss. The APD process allows BLM and WGFD personnel the opportunity to review status of leks relative to project activities and determine necessary courses of action to ensure that greater sage-grouse leks are not significantly impacted. By definition, all lek buffer areas are overlapped by greater sage-grouse nesting habitat. Lek buffer areas were also overlapped by pronghorn crucial winter/yearlong range (112 acres) and raptor nest buffer areas (104 acres) (HWA 2002). Because disturbance within the 0.25-mile lek buffer areas would be avoided, no impacts in these overlap areas are expected.

Nesting. Development of 4 well locations within a section located entirely within 2 miles of a greater sage-grouse lek would remove approximately 54.5 acres, or 8.5%, of the habitat in that section. To protect greater sage-grouse nesting habitats, the BLM would not allow construction activities within a 2-mile radius of greater sage-grouse leks between March 1 and June 30. A total of 133 sections (55,689 acres) within the DFPA contain portions of the 2-mile buffers surrounding greater sage-grouse leks (Figure 4-7). Two sections of the project area located within the MVMA contain portions of the 2-mile buffer surrounding one lek. Not all habitat within 2 miles of leks would provide quality nesting habitat for greater sage-grouse. Areas with mature stands of sage brush would provide the best quality nesting habitat. Avoidance of these areas, as identified by the BLM, on a case-by-case basis, would reduce impacts to greater sage-grouse nesting habitat. Greater sage-grouse nesting buffer areas are overlapped most often by raptor nest buffer areas (17,363 acres), followed by mountain plover habitat (1,886 acres) (HWA 2002). Significant impacts in these areas of overlapping resources are not expected if the mitigation measures for each of these individual resources are implemented.

Wintering Areas. The areas classified as severe winter relief habitats (Figure 3-10) total approximately 209 acres and are located within 19 different sections of the DFPA (HWA 2002). None of these sections are located within the MVMA. This habitat would be crucial for greater sage-grouse survival during severe winters, therefore, surface disturbance would be avoided within these 209 acres. These wintering areas are overlapped most often by greater sage-grouse nesting areas (69 acres), followed by overlap by both raptor nest buffer areas and greater sage-grouse nesting areas (60 acres) (HWA 2002). Because disturbance within these wintering areas would be avoided, no impacts in these overlap areas are expected.

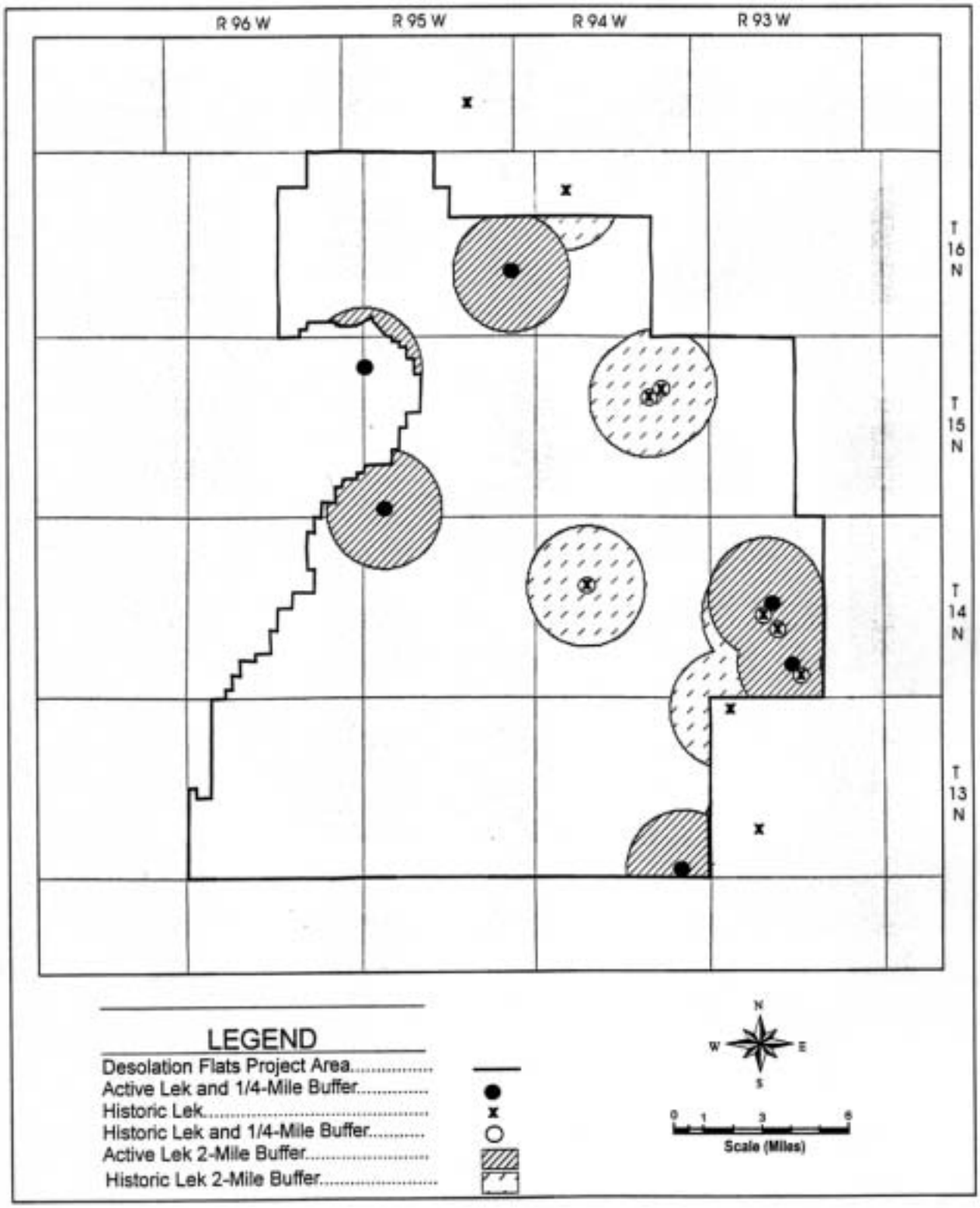


Figure 4-8. Greater Sage-Grouse Lek Locations and Buffer Zones within the Desolation Flats Project Area.

If, during the course of the gas field development, additional leks or severe winter relief habitat areas are identified, the aforementioned mitigation measures would apply. Greater sage-grouse using leks and hens nesting adjacent to roads may experience some disturbance and potential mortality from vehicle collisions as development of the gas field progresses. This potential mortality is not likely to significantly affect the greater sage-grouse population within the project area. Through seasonal closures, reclamation, avoidance, and mitigation measures, significant impacts to the greater sage-grouse population would not be expected to occur as a result of implementation of the Proposed Action.

Mourning Dove. Both migratory and nesting populations of mourning doves have been recorded within the region and it is likely that they occur on the project area (WGFD 2000c). Mourning doves would be expected to concentrate along the riparian habitats within the project area. These habitats are very limited within the DFPA, and impacts to mourning doves as a result of implementation of the Proposed Action are not expected.

4.7.3.1.5 Raptors

The potential impacts that the Proposed Action could have on raptors within the DFPA include: (1) nest desertions and/or reproductive failure due to project activities or increased public access, (2) temporary reductions in prey populations, and (3) mortality associated with roads. Based on aerial and ground inventories conducted in the spring and summer of 2000, and historic BLM records, 204 raptor nests were identified within a one-mile buffer of the DFPA (HWA 2002). Nests which were tended or active during 2000 include: two ferruginous hawk, three red-tailed hawk, and four golden eagle nests. Although several other species of raptors were observed, or are known to occur on the project area, the status of nesting is unknown (see Section 3.7.7). One-mile buffers were placed around all of the raptor nest sites and the majority of sections within the DFPA (296 of 377; 78.5%) included at least some portion of a raptor nest buffer. In the MVMA portion of the project area, 21 out of 24 sections included at least some portion of a raptor nest buffer. Raptor nest buffer areas are overlapped most often by greater sage-grouse nesting area buffers (17,363 acres), followed by mountain plover habitat (6,658 acres) (HWA 2002). Significant impacts in these areas of overlapping resources are not expected if the mitigation measures for each of these individual resources are implemented.

The primary potential impact to raptors from project activities is disturbance during nesting that might result in reproductive failure. To minimize this potential, disturbance would not be allowed during the critical nesting season (Feb. 1 - July 31, depending on species) within 1 mile of an active nest of listed or sensitive raptor species, and 3/4 - ½ mile (depending upon species or line of sight) of an active nest of other raptor species. The nature of the restrictions, exclusion dates, and the protection radius would vary, depending upon activity status of nests, species involved, natural topographic barriers, and line-of-sight distances, and would be determined by the BLM. Nests not used in one year, may potentially be used in subsequent years. Development within close proximity to these nests may preclude use of the nest in following years. Therefore, protection of nests that may potentially be used in future years, such as limiting construction of permanent above-ground structures within 300m (depending upon species and/or line of sight), would minimize impacts. If “take” of an inactive nest is unavoidable, development of artificial nesting structures would mitigate for the loss of the nest. In some instances, during the production phase when human activity is reduced, raptors may actually nest on structures associated with gas production. Given the application of these mitigation measures, significant impacts to raptor nesting activities are not expected.

The development of proposed well pads and associated roads and pipelines would initially disturb an estimated 4,923 acres of potential habitat for several species of small mammals that serve as prey items for raptors. This short-term impact would affect approximately 2.1 percent of the project area and is not likely to be the determining factor of raptor use within the project area. The small amount of short-term change in prey base populations created by the construction associated with the proposed action is minimal in comparison to the overall status of the rodent and lagomorph populations. While prey populations on the project area would likely sustain some impact during the initial phase of the project, prey numbers would be expected to soon rebound to pre-disturbance levels following reclamation of approximately 56 percent of the total initial disturbance area involving pipelines, unused portions of well pads and roads, and wells that are no longer productive. Once reclaimed, these areas would likely promote an increased density and biomass of small mammals that is comparable to those of undisturbed areas (Hingtgen and Clark 1984). For these reasons, implementation of the Proposed Action is not expected to produce any appreciable long-term negative changes to the raptor prey base within the project area.

The creation of new roads would increase public access to areas within the project area. As use of the project area by both workers and recreationists increases, the potential for encounters between raptors and humans would increase and could result in increased disturbance to nests and foraging areas. Closure of roads located near active raptor nests to public vehicle use would offset this potential impact.

Some raptor species feed on road-killed carrion on and along the roads, while others (owls) may attempt to capture small rodents and insects that are illuminated in headlights. These raptor behaviors put them in the path of oncoming vehicles where they are in danger of being struck and killed. The potential for such collisions can be reduced by requiring that regular drivers undergo training that describes the circumstances under which vehicular collisions are likely to occur and the measure that can be taken to minimize them. The application of mitigation measures described in Section 2.5.2.11.2 and 4.7.6 would minimize impacts, and significant impacts to raptors utilizing the DFPA are not expected.

4.7.3.1.6 Combinations of Wildlife Concerns

The maximum number of potential wildlife concerns located within a single section is 5 (resource codes #33 and #41 in Appendix G) and this occurred in only two sections (T16N:R95W Section 23; T16N:R94W Section 16). A single known wildlife resource of concern is present in 117 sections; two are present in 146 sections; three in 73 sections; four in 20 sections; and five in 2 sections. The most frequently occurring resource codes for sections within the DFPA were: #8 - raptor nest buffer (92 sections); #21 - greater sage-grouse nesting and raptor nest buffer (51 sections); #12 - raptor nest and big game crucial winter range (30 sections); #9 - raptor nest buffer and mountain plover habitat (28 sections); and #11 - raptor nest buffer, prairie dog colony, and mountain plover habitat (19 sections) (Appendix G). These 5 wildlife resource codes include 220 sections (58.3%) of the DFPA, and the remaining 36 codes constitute the remaining 157 (41.7%) sections. Sections with the most wildlife resource concerns were generally located in the northwest, northeast, and southeast corners of the DFPA and along the extreme southern edge of the DFPA. The central portion of the DFPA tended to have fewer wildlife resource concerns present. The more wildlife resources that are present within a section the greater the potential for impacts from disturbance. Therefore, when 4-5 wildlife resource concerns are present within a section (22 sections), the BLM may consider a reduction in the number of well locations (< 4) allowed within that section if well

placement does not adequately avoid the resource concerns within the section. If this approach is followed, significant impacts are not expected.

The areas within the DFPA where wildlife resource concerns overlap are illustrated in Figure 4-7. Forty-seven combinations of overlapping wildlife resource concerns were identified within the DFPA; these are listed in detail in the Wildlife and Fisheries Technical Report for this project (HWA 2002). The maximum number of overlapping resource concerns is 4. Nearly 3/4 of the DFPA (173,252 acres; 74.1%) contains at least one wildlife resource concern. The 5 types of wildlife concerns that covered the most area within the DFPA were: raptor nest buffer areas (70,561 acres), greater sage-grouse lek buffer areas (28,309 acres), overlap of raptor nest and greater sage-grouse lek buffers (17,363 acres), mule deer crucial winter/yearlong range (11,059 acres), and potential mountain plover habitat (8,590 acres). Together, these 5 types cover 135,884 acres, or 58.1% of the DFPA. The remaining 42 types of overlapping wildlife concerns cover 37,422 acres, or 16% of the DFPA. The area of the DFPA that contains overlapping wildlife resources is: no known wildlife resources, 60,291 acres; 1 wildlife resource, 120,808 acres; 2 overlapping resources, 45,618 acres; 3 overlapping resources, 6,590 acres; and 4 overlapping resources, 235 acres. The more wildlife resource concerns overlap, the greater the potential for impacts resulting from disturbance.

4.7.3.2 Alternative A

As described in detail in Section 2.3, a total of 592 new natural gas wells would be drilled and developed on a total of 555 new well locations under Alternative A during the 20-year construction period. Development at this level would impact approximately 7,582 acres of wildlife habitat over the next twenty years including a total of 161 acres for ancillary facilities. Approximately 3,300 acres would remain disturbed following reclamation. It is assumed that maximum well pad density would be 4 per section. Well placement within the DFPA is not known at this time, therefore it was assumed that any section may potentially be developed.

4.7.3.2.1 General Wildlife

The analysis for Alternative A is identical to that presented under the Proposed Action (4.7.4.1.1) except that the potential for impacts under Alternative A is proportionately higher than the Proposed Action because of the greater number of well pads (555 v. 361) and post-reclamation disturbance (3,300 v 2,139 acres).

4.7.3.2.2 Big Game

Pronghorn Antelope

The analysis of potential impacts to pronghorn due to habitat loss, displacement, and vehicle collisions is identical to that presented under Proposed Action (4.7.4.1) except that the potential for significant impacts under Alternative A is proportionately greater than the Proposed Action because of the increased number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v. 2,139 acres).

Mule Deer

The analysis of potential impacts to mule deer due to habitat loss, displacement, and vehicle collisions is identical to that presented under Proposed Action (4.7.4.1) except that the potential for significant impacts under Alternative A is proportionately greater than the Proposed Action because of the increased number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v. 2,139 acres).

White-tailed Deer

The analysis for this alternative is identical to that presented under the Proposed Action (4.7.3.1).

Elk

The analysis of potential impacts to elk due to habitat loss, displacement, and vehicle collisions is identical to that presented under Proposed Action (4.7.3.1) except that the potential for significant impacts under Alternative A is proportionately greater than the Proposed Action because of the increased number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v. 2,139 acres).

Overlapping Big Game Crucial Winter Range

The analysis of potential impacts to overlapping big game crucial winter ranges due to habitat loss is identical to that presented under Proposed Action (4.7.3.1) except that the potential for significant impacts under Alternative A is proportionately greater than the Proposed Action because of the increased number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v. 2,139 acres).

4.7.3.2.3 Wild Horses

The analysis of potential impacts to wild horses due to habitat loss and displacement is identical to that presented under Proposed Action (4.7.3.1) except that the potential for significant impacts under Alternative A is proportionately greater than the Proposed Action because of the increased number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v. 2,139 acres).

4.7.3.2.4 Upland Game Birds

Greater Sage-grouse. The analysis of potential impacts to greater sage-grouse is identical to that presented under Proposed Action (4.7.3.1) except that the potential for significant impacts under Alternative A is proportionately greater than the Proposed Action because of the increased number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v. 2,139 acres).

Mourning Dove. The analysis of potential impacts to the mourning dove is identical to that presented under Proposed Action (4.7.3.1).

4.7.3.2.5 Raptors

The analysis of potential impacts to raptors due to habitat loss and displacement is identical to that presented under Proposed Action (4.7.3.1) except that the potential for significant impacts under Alternative A is proportionately greater than the Proposed Action because of the increased number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v. 2,139 acres).

4.7.3.2.6 Combinations of Wildlife Concerns

The analysis for Alternative A is identical to that presented under the Proposed Action (4.7.4.1.6) except that the potential for impacts under Alternative A is proportionately higher than the Proposed Action because of the greater number of well locations (555 v. 361) and post-reclamation disturbance (3,300 v 2,139 acres).

4.7.3.3 Alternative B - No Action

Under the No Action Alternative, the Proposed Action would not be implemented and further drilling would be allowed on federal lands to the extent that it would be within the scope of existing environmental analyses (Mulligan Draw and Dripping Rock decisions) and individual APD's that would be approved on a case-by-case basis. Wildlife resource impacts would be similar to those described above. In terms of magnitude, such impacts would likely be slightly less than for the Proposed Action.

4.7.4 Impacts Summary

The implementation of the Proposed Action or Alternative A would result in direct losses of habitat from surface disturbance associated with the construction of well sites and related access roads and pipelines. In addition, some wildlife species would be indirectly impacted by temporary displacement from habitats in the vicinity of the project area due to the presence of human activities associated with the construction and operation of wells. The potential for collisions between wildlife and motor vehicles would also increase due to the construction of new roads and increased traffic levels on existing roads. The severity of these impacts would be expected to decrease with the completion of the construction phase and with the onset of reclamation efforts on many of the disturbed areas.

The nature of impacts to wildlife is similar between the Proposed Action and Alternative A. The magnitude of potential impacts would be greater under Alternative A, because of the greater number of well sites and increased number of miles of associated access roads and pipelines. The implementation of the Proposed Action would result in 35.1 percent less wildlife habitat being affected than under Alternative A. The implementation of Alternative B would result in wildlife and their habitat being affected within the scope of existing environmental analyses and case-by-case situations, limiting disturbance in comparison to the Proposed Action.

Impacts to the wildlife species in Section 4.7.4 resulting from development of the Proposed Action or Alternative A are not expected to meet the significance criteria in Section 4.7.2 following implementation of the mitigation measures in Sections 2.5.2.11.2 and 4.7.6 because: (1) impacts would not result in non-compliance with existing BLM, FWS, or WGFD management objectives for wildlife; (2) impacts would not cause a substantial increase in direct mortality of wildlife; (3) crucial wildlife habitats would not be permanently reduced in size or rendered unsuitable; (4) long-term

declines in recruitment and/or survival of wildlife populations are not expected; and (5) reproductive success of greater sage-grouse and raptors would not be threatened.

4.7.5 Additional Mitigation Measures

In addition to mitigation measures outlined in Section 2.5.2.11.2, the BLM may require implementation of the following mitigation measures to minimize impacts to wildlife species:

- In areas of overlapping big game crucial winter range, the number of locations may be reduced (less than 4) in order to minimize habitat loss.
- Off-site mitigation such as vegetation enhancement in adjacent areas may be implemented, on a site specific basis, if areas of overlapping big game crucial winter ranges are disturbed.
- Roads located in big game crucial winter range may be closed, on a site specific basis, to public use from November 15-April 30 to minimize disturbance.
- When 4-5 wildlife resource concerns are present within a section, the BLM may consider a reduction in the number of well locations (< 4) allowed within that section if well placement does not adequately avoid the resources.
- In areas where 4 wildlife resources of concern overlap, the BLM may consider avoidance of these areas in order to reduce impacts.
- No permanent above-ground structures would be constructed within 300m or less, depending upon species and/or line of sight, of any raptor nest, on a site specific basis.
- Where “take” of a raptor nest is unavoidable, the erection of 2 artificial nesting structures may be required by the BLM.
- Surface disturbance within 2 miles of greater sage-grouse leks should avoid quality nesting habitat, where possible, on a site-specific basis.

4.7.6 Residual Impacts

The additional potential mitigation measures in Section 4.7.5 would reduce potential impacts in the following ways: (1) limiting disturbance within overlapping crucial big game winter range would reduce forage loss and potential impacts to over-winter survival would be reduced, (2) vegetation enhancement adjacent to disturbed overlapping crucial winter range would provide additional forage for big game, especially during harsh winters, and potential impacts to over-winter survival would be reduced, (3) road closures would reduce disturbance to wintering big game and potential impacts to over-winter survival would be reduced, (4) reducing the number of well locations within sections with 4-5 wildlife resources would reduce impacts to at least some of the wildlife resource concerns within those sections, (5) avoidance of areas where 4 wildlife resource concerns overlap would reduce potential impacts to those 4 wildlife resource concerns simultaneously, (6) restricting construction of structures within 300 meters of raptor nests, depending upon site specific conditions, would reduce disturbance near nests and the potential impacts of nesting territory abandonment would be reduced, (7) construction of artificial nesting structures would provide raptors alternative nesting sites, and the potential impact of reduced raptor nesting would be

reduced, and (8) avoidance of quality greater sage-grouse nesting habitat would reduce the potential impact of reduced greater sage-grouse nesting success.

4.8 SPECIAL STATUS PLANT, WILDLIFE, AND FISH SPECIES

4.8.1 Threatened, Endangered or Proposed for Listing Species of Plants, Wildlife, and Fish

In accordance with Section 7(c) of the Endangered Species Act of 1973, as amended, the Cheyenne Office of the FWS has determined that the following threatened, endangered, or species proposed for listing under the Act, may be present on the DFPA (USDI-FWS 2002a). The threatened, endangered, and proposed wildlife, fish, and plant species that may occur on or near the DFPA are listed below.

Species	Status	Expected Occurrence
Black-footed ferret (*Mustela nigripes*)	Endangered	Potential resident in prairie dog colonies.
Canada lynx (*Lynx canadensis*)	Threatened	Potential resident of forested areas.
Bald eagle (*Haliaeetus leucocephalus*)	Threatened	Potential nesting, winter resident, migrant.
Mountain plover (*Charadrius montanus*)	Proposed	Grasslands statewide.
Bonytail (*Gila elegans*)	Endangered	Downstream resident of Green River system
Colorado pikeminnow (*Ptychocheilus lucius*)	Endangered	"
Humpback chub (*Gila cypha*)	Endangered	"
Razorback sucker (*Xyrauchen texanus*)	Endangered	"
Ute ladies'-tresses	Threatened	Riparian wet meadows

4.8.1.1 Impact Significance Criteria

Impacts to species of special concern including threatened, endangered, and species proposed for listing would be considered significant if any of the following was to occur:

- Project-related impacts that jeopardized or substantially decelerated the recovery program of any listed or proposed species.

- If the BA (USDI-BLM and HWA 2002, Appendix I), according to Section 7 of the ESA of 1973, concludes a "likely to adversely affect" determination, BLM would initiate formal consultation with FWS.

4.8.1.2 Direct and Indirect Impacts

See Section 4.7.3 for discussion of the analysis approach. Wildlife habitats directly affected by the proposed project include areas which are physically disturbed by the construction of wells, roads, pipelines, and production facilities; wildlife habitats indirectly impacted include areas surrounding directly impacted habitats. Disturbance during construction and production such as human presence and noise may displace or preclude wildlife use of these areas. Wildlife sensitivity to these direct/indirect impacts varies considerably with each animal species. Potential direct and indirect impacts to threatened, endangered, and proposed wildlife and fish species are discussed in the following sections. The Wildlife Monitoring/Protection Plan (Appendix H) would be used to detect any potential unanticipated impacts to threatened, endangered, and proposed wildlife and fish species throughout the LOP.

4.8.1.2.1 Proposed Action

As described in detail in Section 2.2, a total of 385 new natural gas wells at 361 well locations would be drilled and developed under this alternative during the next 20 years with an expected life-of-project of 30-50 years. It is assumed that maximum well pad density would be 4 per section. Well placement within the DFPA is not known at this time, therefore it was assumed that any section may potentially be developed.

Nine species (two mammals, two birds, four fish, one plant) are listed as threatened, endangered, or proposed by the FWS under the ESA and may potentially be found in the project area or be affected by activities conducted on the project area (USDI-FWS 2002a). These include the black-footed ferret, Canada lynx, bald eagle, mountain plover, bonytail, Colorado pikeminnow, humpback chub, razorback sucker, and Ute ladies'-tresses.

Wildlife Species

Black-Footed Ferret. The DFPA supports white-tailed prairie dog colonies that meet the requirements for providing potential black-footed ferret habitat. White-tailed prairie dog colonies are located within portions of 67 sections of the DFPA. White-tailed prairie dog colonies were overlapped most often by both raptor nest buffer areas and mountain plover habitat (1,445 acres), followed by raptor nest buffer areas (1,276 acres) (HWA 2002). Significant impacts in these areas of overlapping resources are not expected if the mitigation measures for each of these individual resources are implemented.

Under the Proposed Action, potential black-footed ferret habitat may be disturbed if wells and associated facilities are constructed in white-tailed prairie dog colonies that meet the requirements for black-footed ferret habitat (Biggins et al. 1989, USDI-FWS 1989). Adverse impacts to black-footed ferret habitat from implementation of the Proposed Action would be avoided by not allowing surface disturbance within 50 meters of white-tailed prairie dog colonies. In the event that this can not occur, a black-footed ferret survey of suitable prairie dog towns in which ground disturbing activities are proposed would be conducted (USDI-FWS 1989). If no ferrets are found, the area would be cleared for development for one year. No ground disturbing activities would occur within a colony if a ferret is found. Through these measures, the Proposed Action is not expected to adversely affect the black-footed ferret within the project area.

Canada Lynx. Suitable habitat for this species is not available on the DFPA and no impacts are expected.

Bald Eagle. No bald eagle nests are known to occur on the project area, and WOS records (WGFD 2000a) indicate that the project area is occasionally used by this species primarily during the winter months (November through March). No winter concentration areas and/or winter night-time roosts have been documented on or within one mile of the DFPA.

Because the project area overlaps the winter ranges of major big game species, the potential for vehicle collisions with big game would increase as a result of increased vehicular traffic associated with construction of the Proposed Action. Because bald eagles commonly feed on carrion, particularly during the winter months, the presence of road-killed big game carcasses on and adjacent to the access roads is an attractant. Eagles feeding on these carcasses are in danger of being struck by moving vehicles. Because the potential for an increase in the incidence of vehicle-bald eagle encounters exists, mitigative measures to avoid and/or reduce such incidents should be taken. Such measures should include: (1) require that regular drivers undergo training describing the circumstances under which vehicular collisions with bald eagles are likely to occur and the measures that can be employed to minimize them, and (2) removal of vehicle-killed carcasses from the ROW's of access roads on the project area to eliminate the exposure of carrion-feeding eagles to the threat of being struck by vehicles.

Given the implementation of these mitigation measures, no adverse effects to bald eagles are expected.

Mountain Plover. Short grass, very short shrub, or cushion plant communities are considered potential mountain plover nesting habitat, although mixed grass prairie (i.e. shortgrass prairie dominated by blue grama and buffalo grass) on flat slopes (# 3%) provides optimal mountain plover nesting habitat (Parrish et al. 1993). Potential mountain plover habitat comprises a total of 10.9 percent (25,415 acres) of the DFPA. During 2000 and 2001 field surveys, plovers were observed by HWA biologists in potential mountain plover polygons totaling 9,202 acres. No plovers were observed in the remaining 16,213 acres of potential mountain plover habitat (HWA 2002). Potential mountain plover habitat is present within 104 sections of the DFPA, and 18 sections within the MVMA portion of the DFPA contain potential mountain plover habitat. Mountain plover habitat was most often overlapped by raptor nest buffer areas (6,658 acres), followed by pronghorn crucial winter/yearlong range (2,400 acres) (HWA 2002). Significant impacts in these areas of overlapping resources are not expected if the mitigation measures for each of these individual resources are implemented.

A portion of the suitable mountain plover nesting habitat may be disturbed with implementation of the Proposed Action. Impacts to mountain plovers would be minimized by avoiding construction activities in suitable plover nesting habitat during the nesting period from April 10-July 10, and/or avoiding surface disturbance within areas of suitable plover nesting habitat the remainder of the year. The status of nests may change annually, and mountain plover nest activity status and location surveys must be kept current. Any mountain plover surveys that are conducted would follow the most current mountain plover survey guidelines from the FWS (USDI-FWS 2002b). Mountain plovers often nest near roads, feed on or near roads, and use roads as travel corridors (USDI-FWS 1999), all of which make the species susceptible to being killed by vehicles. Thus, the operators may be required to warn employees about the potential for roadside and roadway use by the species. Minimization of the amount of travel done at night and driving speeds would reduce

the potential for roadkill of mountain plovers. The BLM may also identify mountain plover "occupied habitat areas" and if these areas are disturbed, additional mitigation measures may be required to minimize impacts to mountain plovers (see Section 4.8.1.4). Implementation of some of these additional measures would be agreed to by the BLM and operators. If the mountain plover is listed as a threatened species, formal consultation with the FWS would be necessary. Given the implementation of mitigation measures in Sections 2.5.2.11.2 and 4.8.1.4, no adverse effects to mountain plovers are expected.

Combinations of Wildlife Concerns. The only combination of wildlife concerns to potentially include multiple threatened, endangered, or proposed species was the overlap between mountain plover habitat and white-tailed prairie dog colonies, which may support black-footed ferrets (2,755 acres). These areas were primarily located in the northwest, northeast, and southeast corners of the DFPA (see Figure 4-7). Significant impacts in these areas are not expected provided that the mitigation measures for both of these individual resources are implemented.

Fish Species

There are four species of fish in the upper Colorado River System that are federally listed as endangered. They are the Colorado pikeminnow (*Ptychocheilus lucius*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*) (USDI-FWS 2002a). Though they currently exist only downstream of the DFPA, water draining from the DFPA affects the downstream habitat for these species. Under the *Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin* (RIP), "any water depletions from tributary waters within the Colorado River drainage are considered as jeopardizing the continued existence of these fish." Tributary water is defined as water that contributes to instream flow habitat. Depletion is defined as water which would contribute to the river flow if not intercepted and removed from the system.

The BLM retains discretionary authority over individual projects within the area for the purpose of endangered species consultation. If the recovery program is unable to implement the RIP in a timely manner or make sufficient progress in recovery of these endangered species, re-initiation of Section 7 consultation may be required so that new reasonable and prudent alternatives can be developed.

The FWS has determined that progress made under the RIP has been sufficient to merit a waiver of the mitigation fee for depletions of 100 acre-feet per year or less (Memorandum dated March 9, 1995 to Assistant Regional Director, Ecological Services, Region 6, from Regional Director 6, "Intra-Service Section 7 Consultation for Elimination of Fees for Water Depletions of 100 acre-feet or Less from the Upper Colorado River Basin"). The Proposed Action would deplete approximately 29.1 acre-feet of water per year, and thus a mitigation fee waiver would be applicable.

Colorado Pikeminnow. Suitable habitat for the Colorado Pikeminnow does not exist on the DFPA. Suitable habitat does exist downstream of the DFPA, however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water and soils outlined in this document are implemented.

Bonytail. Suitable habitat for adult bonytail is absent from the DFPA and the sediment rich nature of Sand Creek likely precludes successful spawning by bonytail. Suitable habitat does exist downstream of the DFPA, however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water and soils outlined in this document are implemented.

Humpback Chub. Suitable habitat for adult humpback chub is absent from the DFPA and the sediment rich nature of Sand Creek likely precludes successful spawning by humpback chub. Suitable habitat does exist downstream of the DFPA, however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water and soils outlined in this document are implemented.

Razorback Sucker. Suitable habitat for this species is not available on the DFPA. Although the sediment rich nature of Sand Creek may be suitable for successful spawning by the razorback sucker, its small size probably precludes it from spawning in Sand Creek. Suitable habitat does exist downstream of the DFPA, however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water and soils outlined in this document are implemented.

Plant Species

Ute ladies'-tresses. The Ute ladies'-tresses is not expected to occur on or near the DFPA due to the following reasons: (1) The DFPA is very arid and perennial streams are not present, (2) the elevation of the project area is near the upper limit for the species, (3) moist riparian area meadows are not present, (4) perennial streams are not present, (5) the transition from stream margins to upland vegetation is abrupt, and (6) the species has only been located in eastern and southeastern Wyoming (Fertig 2000). Therefore, implementation of the Proposed Action is not expected to impact the Ute ladies'-tresses.

4.8.1.2.2 Alternative A

As described in detail in Section 2.3, a total of 592 new natural gas wells would be drilled and developed on a total of 555 new well pads under Alternative A during the 20-year construction period. Development at this level would impact approximately 7,582 acres of wildlife habitat over the next 20 years including a total of 161 acres for ancillary facilities. Approximately 3,300 acres would remain disturbed following reclamation. It is assumed that maximum well pad density would be 4 per section. Well placement within the DFPA is not known at this time, therefore it was assumed that any section may potentially be developed.

Wildlife Species

Black-Footed Ferret. The analysis for Alternative A is identical to that presented under the Proposed Action (4.8.1.2.1) except that the potential for impacts under Alternative A is proportionately higher than the Proposed Action because of the greater number of well pads (555 v. 361) and post-reclamation disturbance (3,300 v 2,139 acres).

Canada Lynx. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

Bald Eagle. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

Mountain Plover. The analysis for Alternative A is identical to that presented under the Proposed Action (4.8.1.2.1) except that the potential for impacts under Alternative A is proportionately higher than the Proposed Action because of the greater number of well pads (555 v. 361) and post-reclamation disturbance (3,300 v 2,139 acres).

Combinations of Wildlife Concerns. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

Fish Species

Colorado Pikeminnow. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

Bonytail. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

Humpback Chub. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

Razorback Sucker. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

Plant Species

Ute ladies'-tresses. The analysis for Alternative A is identical to that previously described under the Proposed Action (4.8.1.2.1).

4.8.1.2.3 Alternative B - No Action

Under the No Action Alternative, the Proposed Action would not be implemented and further drilling would be allowed on federal lands only to the extent that it would be within the scope of existing environmental analyses. Wells would continue to be drilled under the Mulligan Draw and Dripping Rock decisions, and individual APD's would be approved on a case-by-case basis. Wildlife resource impacts would be similar to those described above. In terms of magnitude, such impacts would likely be considerably less than for the Proposed Action. However, there would be an increased probability of occurrence of unexpected adverse impacts since overall field development would not happen in a well-planned and monitored manner.

4.8.1.3 Impacts Summary

With the implementation of the Proposed Action or Alternative A, direct loss of habitat would result from surface disturbance associated with the construction of well sites and related access roads and pipelines. Small proportions of potential mountain plover and black-footed ferret habitat may be disturbed. The potential for collisions between bald eagles and motor vehicles would also increase due to the construction of new roads and increased traffic levels on existing roads. The intensity of these impacts would decrease with the completion of the construction phase and with the onset of reclamation efforts on many of the disturbed areas. The probability for impacts to wildlife and the intensity of such impacts would be greater under Alternative A than the Proposed Action. The application of prescribed avoidance, monitoring (Wildlife Monitoring/Protection Plan,

Appendix H) and mitigation measures (Sections 2.5.2.11.2, and 4.8.1.4) would reduce the impact potential and allow for either of the action alternatives to be performed without significant impacts to listed and proposed wildlife species.

None of the 4 threatened and endangered fish species are known to occur on the DFPA, therefore there would be no direct impacts within the project area. However, the species do occur downstream of the DFPA. Water depletion as a result of project development would be much less than 100 acre-feet per year, and a mitigation fee waiver would be applicable, and significant impacts to these species are not likely. Implementation of all mitigation measures for water and soils would result in no impacts to threatened and endangered fish species located downstream. If any of these species are identified within the downstream portion of Sand Creek, the BLM should consult with the FWS and develop a protection plan for the fish. No impacts to these 4 fish species are expected to result from the implementation of either the Proposed Action or Alternative A. Suitable habitat for the Ute ladies'-tresses is not present within the DFPA, and no impacts to this species are expected.

Impacts to the wildlife species in Section 4.8.1 resulting from development of the Proposed Action or Alternative A are not expected to meet the significance criteria in Section 4.8.1.1 following implementation of the mitigation measures in Sections 2.5.2.11.2 and 4.8.1.4 because: (1) project development is not expected to jeopardize the recovery program of any listed or proposed species; and (2) the BA concluded that the proposed development is "not likely to adversely affect" the threatened, endangered, and proposed species; and (3) if the mountain plover is listed in the future, then formal consultation would be implemented.

4.8.1.4 Additional Mitigation Measures

In addition to mitigation measures outlined in Section 2.5.2.11.2, the BLM may require the following mitigation measures to minimize impacts to threatened, endangered, and proposed wildlife species:

- Surface disturbance would be placed in habitat not suitable for mountain plovers where feasible.

- Vehicle-killed wildlife would be removed from road ROW's to avoid attracting scavenging species such as bald eagles to roadways where they may be struck and killed by vehicles.

- If any of the threatened, endangered, or proposed fish species are identified within the downstream portion of Sand Creek, the BLM would consult with the FWS and develop a protection plan for the fish.

Some of the following mountain plover protection measures may be implemented following consultation between the BLM and operators if mountain plover "occupied habitat areas" are disturbed:

- To protect the identified mountain plover occupied habitat area, the proposed activity would not be allowed as proposed. An alternative such as moving the facility, directional drilling, piping and storage of condensate off the identified mountain plover occupied habitat area to a centralized facility, or other technique for the minimization of ground disturbance and habitat degradation would be required.

- To protect the identified mountain plover occupied habitat area, the proposed facility would be moved ½ mile from the identified occupied habitat area.

- To protect the identified mountain plover occupied habitat area and because mountain plover adults and broods may forage along roads during the night, traffic speed and traffic volume would be limited during night-time hours from April 10 to July 10.

- Within ½ mile of the identified mountain plover occupied habitat area, speed limits would be posted at 25 mph on resource roads and 35 mph on local roads during the brood rearing period (June 1 - July 10).

- The access road would be realigned to avoid the identified mountain plover occupied habitat area.

- To protect the identified mountain plover occupied habitat area, traffic would be minimized from June 1 - July 10 by car-pooling and organizing work activities to minimize trips on roads within ½ mile of the mountain plover occupied habitat area.

- To protect the identified mountain plover occupied habitat area, work schedules and shift changes would be modified from June 1 - July 10 to avoid the periods of activity from ½ hour after sunset to ½ hour before sunrise.

- To protect the identified mountain plover occupied habitat area, fences, storage tanks, and other elevated structures would be either constructed as low as possible and/or would incorporate perch-inhibitors into their design.

- Road-killed animals would be promptly removed from areas within ½ mile of the identified mountain plover occupied habitat area.

- To protect the identified mountain plover occupied habitat area, seed mixes and application rates for reclamation would be designed to produce stands of sparse, low-growing vegetation suitable for plover nesting.

- To minimize destruction of nests and disturbance to breeding mountain plovers, no reclamation activities or other ground-disturbing activities would occur from April 10 - July 10 unless surveys consistent with the Plover Guidelines or other FWS approved method find that no plovers are nesting in the area.

- A plugged and abandoned well within ½ mile of the identified mountain plover occupied habitat area would be identified with a marker 4 feet tall with a perch inhibitor on the top of the marker.

4.8.1.5 Residual Impacts

The additional potential mitigation measures in Section 4.8.1.4 would reduce potential impacts in the following ways: (1) avoidance of disturbance within potential mountain plover habitat would reduce the potential impacts associated with loss of habitat such as reduction in the number of nesting mountain plovers or reduced mountain plover nesting success, (2) removal of carcasses from roads would reduce the potential for direct mortality of species such as bald eagles, (3) if threatened or endangered fish species are found in Sand Creek, consultation with the FWS would

be implemented to reduce potential impacts to these species, (4) implementation of some of the additional mountain plover protection measures would reduce impacts to habitat known to be occupied by mountain plovers, and impacts to nesting mountain plovers would be reduced.

4.8.2 Sensitive Species of Plants, Wildlife, and Fish

Sensitive species includes candidate T&E species and BLM Wyoming State sensitive species (USDI-BLM 2001). A total of 21 plant and 35 wildlife and fish species that have the potential to occur, or are known to occur in the project area, are included as sensitive species (Table 3-24). Although these species have no legal status under the ESA, the BLM maintains an active interest in their numbers and status. The BLM views "management of sensitive species as an opportunity to practice pro-active conservation; this management should not be onerous, or a show-stopper of other legitimate, multiple use activities" (USDI-BLM 2001). The BLM's order of priority for the management of all special status species is: First - listed T&E species; Second - proposed T&E species; Third - candidate T&E species; Fourth - BLM sensitive species; and, Fifth - State listed species (USDI-BLM 2001). The BLM Wyoming Sensitive Species list is meant to be dynamic and will be reviewed annually.

4.8.2.1 Impact Significance Criteria

Impacts to BLM Wyoming state sensitive plant, wildlife, and fish species would be considered significant if the following was to occur:

- Project-related impacts jeopardize the persistence of any BLM Wyoming state sensitive plant, wildlife, or fish species within the state.

4.8.2.2 Direct and Indirect Impacts

See Section 4.7.3 for discussion of the analysis approach. Wildlife habitats directly affected by the proposed project include areas which are physically disturbed by the construction of wells, roads, pipelines, and production facilities; wildlife habitats indirectly impacted include areas surrounding directly impacted habitats. Disturbance during construction and production such as human presence and noise may displace or preclude wildlife use of these areas. Wildlife sensitivity to these direct/indirect impacts varies considerably with each animal species. The potential for impacts to sensitive wildlife species in the portion of the DFPA located within the MVMA is similar to the potential for impacts in the remainder of the DFPA unless otherwise indicated. Potential direct and indirect impacts to sensitive wildlife species are discussed in the following sections. The Wildlife Monitoring/Protection Plan (Appendix H) would be used to detect any potential unanticipated impacts to sensitive wildlife and fish species throughout the LOP.

4.8.2.2.1 Proposed Action

Plants

Management directions emphasize the need to protect plant species of concern. Surface disturbing activities could affect plant species of concern directly and indirectly by destroying individuals or their habitat, increasing the amount of fugitive dust, and introducing invasive, non-native species. The only BLM Wyoming state sensitive plant currently known to occur within the DFPA is Gibbens' beardtongue. The BLM is particularly concerned for the population of Gibbens' beardtongue known

to occur in the eastern portion of the project area. Final planning for the location and alignment of project facilities in this area would require taking the occurrence and distribution of this species into consideration. Avoidance of areas containing the species would eliminate direct impact on the species. Should populations of additional BLM state sensitive plant species be found within the DFPA, similar avoidance measures may be required to avoid significant direct impacts to the those species. Fugitive dust generated during project construction and operation could adversely affect vegetation including sensitive plant species due to deposition on leaves. Although deposition of dust on leaves could have an adverse effect, the magnitude of this impact would likely be minimal. Fugitive dust control has been adopted by the Operators as described in Appendix C, and therefore such an impact would be minimal. With implementation the mitigation recommended in Section 2.5.2.11.2, no significant impacts to sensitive plant species are anticipated under the Proposed Action.

Wildlife

Dwarf Shrew. Dwarf shrews have been captured in eastern Sweetwater County and may be present on the DFPA. Dwarf shrews appear to be able to survive in a wide range of habitats from high altitude alpine tundra to alkaline sagebrush flats. The small percentage of habitat proposed for disturbance within the DFPA under the Proposed Action is not expected to significantly impact dwarf shrews if they are present.

Idaho Pocket Gopher. Idaho pockets gophers have only been confirmed in extreme western Sweetwater County, and they are unlikely to occur on the DFPA. No significant impacts to this species are expected.

Wyoming Pocket Gopher. It is likely that the Wyoming pocket gopher is present in portions of the DFPA. This species utilizes dry ridge tops with dry gravelly soils and greasewood. This species may be abundant within its distribution, but no population studies have been conducted (Clark and Stromberg 1987). No significant impacts to this species are expected with development of the Proposed Action.

Pygmy Rabbit. Pygmy rabbits have been found in western Sweetwater County, which is west of the DFPA. However, the extent of the pygmy rabbit's range in Wyoming is not well known, therefore there is a slight possibility that it may occur in suitable habitat (tall dense sagebrush) in the project area. The small percentage of disturbance on the project area associated with the Proposed Action is not expected to be a significant impact upon pygmy rabbits if they are present.

White-tailed Prairie Dog. White-tailed prairie dog colonies that may provide habitat suitable for black-footed ferrets are present on the project area. If white-tailed prairie dog colonies that provide suitable black-footed ferret habitat are to be disturbed, then black-footed ferret surveys would be conducted (see Section 4.8.1.2.1). It is preferred by the BLM that no disturbance occur within 50 meters of prairie dog colonies, where feasible. The anticipated disturbance of white-tailed prairie dog colonies is expected to be low, and no significant impacts to white-tailed prairie dogs are expected.

Swift Fox. The direct disturbance of 4,923 acres of mixed desert shrub and badlands habitat associated with the construction of the proposed action would reduce habitat availability and effectiveness for swift fox if present. Through reclamation, the amount of disturbance would be

reduced to 2,139 acres. Swift foxes are very adaptable, and this amount of disturbance would not be a significant impact if they are present on the DFPA.

Special Concern Bat Species. The project area provides potential habitat for four special status bat species which include: the spotted bat, fringed myotis, long-eared myotis, and Townsend's big eared bat. Although their distributional ranges overlap the project area, it is difficult to verify their occurrence in the area without extensive mist netting efforts. Bats may potentially use vent pipes associated with well facilities as roost sites. Netting of vents where bats may potentially be killed would prevent this possible impact. The Proposed Action is unlikely to affect other activities of bats such as foraging, food supply, or roosts.

Baird's Sparrow. Because Baird's sparrow is so unlikely to utilize the DFPA except for possible occurrences during late summer or during migration periods, no adverse impacts to this species are expected to result from the implementation of the Proposed Action.

Sage Sparrow. Sage sparrows do occur on the DFPA. Sage sparrows typically utilize stands of big sagebrush or mixed big sagebrush and greasewood for nesting. This is the type of habitat that covers approximately74% of the project area. The proportion of this habitat that may be disturbed is expected to be low, therefore, impacts upon sage sparrows are expected to be minimal.

Brewer's Sparrow. The Brewer's sparrow breeds in landscapes dominated by big sagebrush (*Artemisia tridentata*) throughout the Great Basin and intermountain West (Rotenberry et al. 1999). Brewer's sparrows are known to occur in the southwestern portion of the project area, but are likely present throughout the project area where suitable habitat occurs. Development of the Proposed Action would likely displace some Brewer's sparrows, however, suitable habitat is very abundant throughout the project area, and therefore, no significant impacts to this species are expected.

Long-billed Curlew. Long-billed curlews prefer nesting in arid regions of grassland and shrub habitats of the western plains, and nests are usually located within close proximity to open lakes and sloughs (Dinsmore 1983). In Wyoming, it is an uncommon summer resident. The long-billed curlew has been observed in Carbon and Sweetwater counties, but it has not been reported within the DFPA. The long-billed curlew is not expected to nest on the project area due to lack of habitat, and no significant impacts to this species are expected with implementation of the Proposed Action.

Sage Thrasher. The sage thrasher is considered a sagebrush obligate and is generally dependent on large patches and expanses of sagebrush steppe for successful breeding. Sage thrashers have been observed throughout Wyoming, including areas near the DFPA (WGFD 2000a). Development of the Proposed Action would likely displace some sage thrashers, however, suitable habitat is very abundant throughout the project area, and no significant impacts to this species are expected.

Western Burrowing Owl. Burrowing owls occur throughout the DFPA in many of the prairie dog towns. The number of burrowing owl observations within the DFPA indicate that surveys for this species should be made prior to construction in prairie dog colonies during the owl breeding/nesting season. If nesting owls are found, the same measures used for other raptor species (see Section 4.7.4.1.6) would be applied. Given these precautionary measures, no adverse impacts to this species are expected to result from the implementation of the Proposed Action.

Yellow-billed Cuckoo. In Wyoming, the yellow-billed cuckoo prefers cottonwood stands for foraging and willow thickets for nesting (WYNDD 2001). Yellow-billed cuckoos have not been

observed on or near the project area (WGFD 2000a) and they are not expected to occur due to a lack of suitable habitat. No adverse impacts to this species are expected from implementation of the Proposed Action.

Loggerhead Shrike. Loggerhead shrikes have been observed within the DFPA. Four of the sightings included a pair or more of shrikes, possibly indicating breeding pairs. This species uses thickly foliaged trees and shrubs for nesting and roosting. Construction within this type of habitat may possibly disturb nesting shrikes. However, facilities associated with well development may provide increased perching sites, which shrikes use for hunting. Implementation of the Proposed Action is not likely to adversely effect the loggerhead shrike.

Columbian Sharp-tailed Grouse. There are no historic Columbian sharp-tailed grouse leks documented within the DFPA. No sightings of Columbian sharp-tailed grouse have been reported for the DFPA and no habitat is known to occur within the project area. The species does occur several miles to the east; so the potential for transient Columbian sharp-tailed grouse to be found within the DFPA does exist. The absence of documented leks within the project area makes Columbian sharp-tailed grouse nesting highly improbable, therefore, implementation of the Proposed Action is not likely to adversely effect the Columbian sharp-tailed grouse.

Greater Sage-grouse. See Section 4.7.4.1.5.

White-faced Ibis. White faced ibis feed in wet meadows and shallow water found along streams and lakes and nest in areas with extensive water (Dinsmore 1983). White-faced ibis were observed east of the project area in Muddy Creek near Dad, Wyoming in 1988 (one individual) and 1992 (two individuals) (WGFD 2000a). Riparian habitat is very limited on the DFPA, therefore white-faced ibis are not expected to nest on the project area. The Proposed Action is not expected to significantly impact the white-faced ibis.

Trumpeter Swan. The arid conditions prevailing throughout the DFPA combined with the near absence of large water bodies and perennial streams preclude nesting and residency by trumpeter swans. No trumpeter swans have been documented in the DFPA. Therefore, implementation of the Proposed Action would not impact this species.

Peregrine Falcon. Peregrine falcons normally nest on cliff faces 200 to 300 feet high, although cliffs as high as 2,100 feet have been used (USDI-FWS 1984). An available prey base of shorebirds, waterfowl, and/or small-to-medium sized terrestrial birds usually occurs within ten miles of the nest site. Bird populations in and around the project area may be abundant and diverse enough to support peregrines. However, cliffs high enough to provide suitable nesting habitat are absent. In addition to the apparent lack of suitable habitat, no peregrine sightings have been recorded within the project area (WGFD 2000a). However, peregrine falcons have been observed in Carbon and Sweetwater counties (WYNDD 2001). Peregrine falcons may at times migrate through the project area, but nesting by this species on or near the project area is unlikely. Implementation of the Proposed Action is not expected to significantly impact peregrine falcons.

Ferruginous Hawk. Ferruginous hawks are known to occur and nest on the DFPA. The primary potential impact to ferruginous hawks from project activities is disturbance during nesting, resulting

in reproductive failure. This potential impact would be mitigated by implementing measures that were discussed in Section 4.7.4.1.6 for all raptor species. An activity status survey of raptor nests would be conducted immediately prior to construction near nests to allow for well placement planning and avoidance of impacts to actively nesting birds. With the implementation of mitigation measures in Sections 2.5.2.11.2 and 4.7.6, development of the Proposed Action would not significantly impact the ferruginous hawk.

Northern Goshawk. Due to the facts that: (1) the coniferous nesting habit preferred by this species does not occur on the project area, (2) no nests have been discovered on the project area and two-mile buffer by either the BLM or during recent raptor nest surveys (HWA 2002), and (3) there are no records of nests in either the WOS (WGFD 2000a) or the WYNDD (2000), it is unlikely that goshawks nest on or near the project area and no impacts are expected.

Midget-faded Rattlesnake. In Wyoming, the midget-faded rattlesnake inhabits the lower Green River valley from the cities of Green River and Rock Springs south to the Utah-Wyoming state line. In southwestern Sweetwater County the midget faded rattlesnake is commonly found among rock outcroppings (Baxter and Stone 1992). The documented distribution of the midget-faded rattlesnake in Wyoming is west of the DFPA. However, the eastern extent of its range is not well known and the snake could potentially occur in suitable habitat on the project area. Potential impacts to midget-faded rattlesnake habitat would likely be low because it is difficult to construct well sites and roads in rock outcropping areas, therefore those areas would likely be avoided. Implementation of the Proposed Action is not expected to significantly impact midget-faded rattlesnakes if present.

Boreal Toad. In Wyoming, this species is restricted to mountains and foothills in areas having relatively moist conditions. The range for boreal toads is thought to encompass the Muddy Creek watershed located just east of the project area (Baxter and Stone 1992), and the Wyoming Species Atlas (WGFD 1999) and WYNDD (2001) indicate sightings within both Sweetwater and Carbon counties. However, no sightings of this species within six miles of the project area have been reported in the WOS (WGFD 1999). Habitat within the majority of the DFPA is too arid for this species to be present. Implementation of the Proposed Action is not expected to significantly impact the boreal toad if it is present.

Great Basin Spadefoot Toad. In Wyoming, this species inhabits sagebrush communities at lower elevations, mostly in the Wyoming Basin and the Green River Valley. Sightings of this species have been documented in Sweetwater, Lincoln, Fremont, and Natrona counties of Wyoming (Baxter and Stone 1992) and this species has potential to occur throughout the DFPA. One Great Basin spadefoot was reported within 2 miles of the DFPA (WGFD 2000a). This species may congregate around intermittent springs, seeps, or waterholes. If measures are taken to avoid disturbance of natural springs, seeps, and waterholes, no adverse impacts to this species are expected from implementation of the Proposed Action.

Northern Leopard Frog. The northern leopard frog is an obligate of permanent water in the plains, foothills, and montane zones. Rarely, this frog may be found near temporary water, miles from permanent water. Sightings of this species have been documented in all counties of Wyoming and this species is likely present in any areas of the DFPA having perennial water. If measures are taken to avoid disturbance and/or contamination of perennial water sources (see water and soil sections of this document) within the DFPA, no adverse impacts to this species are expected from implementation of the Proposed Action.

Spotted Frog. The spotted frog typically occurs near cool, permanent, quiet waters such as small streams, rivers, marshes, ponds, sloughs, and springs. Spotted frogs have not been found within a six-mile perimeter of the project area and it is unlikely that suitable habitat occurs on the project area. Implementation of the Proposed Action would not impact the spotted frog.

Combinations of Wildlife Concerns. Specific locations of sensitive wildlife and fish species are limited, and areas where multiple species of concern may overlap have not been identified. If habitat areas that support 4 or more wildlife species of concern are identified in the future, the BLM may develop mitigation measures to ensure that these areas are not significantly impacted by future development. The Wildlife Monitoring/Protection Plan (Appendix H) may be used as a tool to monitor these sensitive species.

Fish

Leatherside Chub. The leatherside chub is restricted to small streams of the Snake, Bear, and Green River watersheds in western Wyoming. The leatherside chub is not known to occur, nor is it expected to occur, within the DFPA, therefore, implementation of the Proposed Action would not impact the leatherside chub.

Roundtail Chub. This species is present within the Little Snake River drainage downstream of the Sand Creek confluence and can also be found in Muddy Creek (Carbon County, Wyoming), a small perennial stream located just to the east of the project area (Baxter and Stone 1995). The absence of perennial water in the downstream portion of Sand Creek and the sediment rich nature of the stream probably preclude successful spawning by roundtail chub in the DFPA. If measures identified in the water and soils sections of this document are taken to prevent downstream sedimentation caused by construction activities under the Proposed Action (WDEQ 1997b, 2000), implementation of the Proposed Action is not likely to adversely affect the roundtail chub.

Bluehead Sucker. This species is known to occur downstream of Sand Creek in the Little Snake River and is found in Muddy Creek (Baxter and Stone 1995). However, populations of the species in Wyoming are considered rare in comparison with other sucker species. If measures identified in the water and soils sections of this document are taken to prevent downstream sedimentation caused by construction activities under the Proposed Action (WDEQ 1997b, 2000), implementation of the Proposed Action is not likely to adversely affect the bluehead sucker.

Flannelmouth Sucker. Because of the types of available stream habitat on the DFPA, this species is not expected to occur. The species does occur downstream in the Little Snake River. If measures identified in the water and soils sections of this document are taken to prevent downstream sedimentation caused by construction activities under the Proposed Action (WDEQ 1997b, 2000), implementation of the Proposed Action is not likely to adversely affect the flannelmouth sucker.

Colorado River Cutthroat Trout. Some of the most genetically "pure" of the remaining populations of this trout subspecies are found in the Little Snake River in Carbon County, Wyoming (Baxter and Stone 1995). This species occurs downstream from the Sand Creek confluence with the Little Snake River. This species requires very low sediment streams with excellent water quality. If precautions are utilized to protect downstream flows in Sand Creek and the Little Snake River, and precautions are taken to limit offsite sediment movement, implementation of the Proposed Action is not likely to adversely affect the Colorado River cutthroat trout.

4.8.2.2.2 Alternative A

Plants

The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater amount of habitat disturbance.

Wildlife

Dwarf Shrew. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Idaho Pocket Gopher. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Wyoming Pocket Gopher. The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater amount of habitat disturbance.

Pygmy Rabbit. The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater amount of habitat disturbance.

White-tailed Prairie Dog. The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater amount of habitat disturbance.

Swift Fox. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Special Concern Bat Species. The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater number of well pads proposed (555 v. 361) and an increase in the number of reserve pits.

Snowy Plover. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Baird's Sparrow. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Sage Sparrow. The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater amount of habitat disturbance.

Brewer's Sparrow. The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater amount of habitat disturbance.

Long-billed Curlew. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Sage Thrasher. The analysis for Alternative A is similar to that previously described under the Proposed Action, but the potential for impacts is higher than for the Proposed Action because of the greater amount of habitat disturbance.

Western Burrowing Owl. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Scott's Oriole. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Yellow-billed Cuckoo. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Loggerhead Shrike. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Columbian Sharp-tailed Grouse. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Greater Sage-grouse. See Section 4.7.4.2.5.

Black Tern. The analysis for Alternative A is identical to that previously described under the Proposed Action.

White-faced Ibis. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Trumpeter Swan. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Peregrine Falcon. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Ferruginous Hawk. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Northern Goshawk. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Midget-faded Rattlesnake. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Boreal Toad. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Great Basin Spadefoot Toad. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Northern Leopard Frog. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Spotted Frog. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Combinations of Wildlife Concerns. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Fish

Leatherside Chub. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Roundtail Chub. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Bluehead Sucker. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Flannelmouth Sucker. The analysis for Alternative A is identical to that previously described under the Proposed Action.

Colorado River Cutthroat Trout. The analysis for Alternative A is identical to that previously described under the Proposed Action.

4.8.2.2.3 Alternative B - No Action

Under the No Action Alternative, the Proposed Action would not be implemented and further drilling would be allowed on federal lands to the extent that it would be within the scope of existing environmental analyses (Mulligan Draw and Dripping Rock decisions), and individual APD's would be approved on a case-by-case basis. Special status wildlife resources impacts would be similar to those described above. In terms of magnitude, such impacts would likely be considerably less than for the Proposed Action.

4.8.2.3 Impacts Summary

With the implementation of the Proposed Action or Alternative A, direct loss of habitat would result from surface disturbance associated with the construction of well sites and related access roads and pipelines. Small proportions of potential habitat for several sensitive species may be disturbed. The intensity of these impacts would decrease with the completion of the construction phase and with the onset of reclamation efforts on many of the disturbed areas. The probability for impacts to sensitive plants and wildlife and the intensity of such impacts would be greater under Alternative

A than the Proposed Action. The application of prescribed avoidance, monitoring (Wildlife Monitoring/Protection Plan, Appendix H) and mitigation measures (Sections 2.5.2.11.2, and 4.8.1.4) would reduce the impact potential and allow for either of the action alternatives to be performed without significant impacts to sensitive plant and wildlife species.

None of the 5 sensitive fish species are known to occur on the DFPA, therefore there would be no direct impacts within the project area. However, several of the species do occur downstream of the DFPA. Water depletion as a result of project development would be much less than 100 acre-feet per year, and no significant impacts to these 5 fish species are expected to result from the implementation of either the Proposed Action or Alternative A.

Impacts to the species in Section 4.8.2 resulting from development of the Proposed Action or Alternative A are not expected to meet the significance criteria in Section 4.8.2.1 following implementation of the mitigation measures in Sections 2.5.2.11.2 and 4.8.2.4 because project development is not expected to jeopardize the persistence of these species in Wyoming.

4.8.2.4 Additional Mitigation Measures

In addition to mitigation measures outlined in Section 2.5.2.11.2, the BLM may require the following mitigation measures to minimize impacts to sensitive wildlife and fish species:

- Surveys for BLM state sensitive species would be conducted on a site-specific basis if deemed necessary by the BLM,

- Screening would be applied on vent pipes at compressor stations to prevent bats from using them as roost sites.

4.8.2.5 Residual Impacts

The additional mitigation measures in Section 4.8.2.4 would reduce potential impacts to special status species in the following ways: (1) surveys for BLM state sensitive species would be used to determine if sensitive species are present in certain areas, and appropriate measures could be implemented to reduce potential impacts, and (2) screening on vent pipes would reduce the potential for sensitive bat species to be killed in pipes.

4.9 RECREATION RESOURCES

4.9.1 Introduction

Well drilling, testing, and production operations, and associated site preparation and construction activities such as those proposed for the DFPA have the potential to cause major alterations to the recreation setting and recreation opportunities available to persons using the area. Some recreationists could be temporarily or permanently displaced from using certain locations associated with drilling and production activities. Displacement of recreationists could also result from changes in the numbers or distribution patterns of wildlife that attract hunters and wildlife observers to the area. The presence of construction and drilling equipment and associated increased evidence of human industrial activities in the area could detract from the recreational

experience. Noise and fugitive dust associated with drilling and production could further degrade the experience of those recreating in the area.

4.9.2 Impact Significance Criteria

The following criteria were used to evaluate the potential significance of recreation impacts:

- Levels or patterns of project equipment and vehicle use that would result in the displacement of recreation activities for more than one season of use, and

- Increased evidence of human activity that would reduce recreationists' perceived levels of isolation and solitude.

4.9.3 Direct and Indirect Impacts

4.9.3.1 Proposed Action

The following discussion assumes a non uniform distribution of wells and support facilities across the landscape with a maximum density of 1 well within the MVMA portion of the DFPA and maximum density of 4 wells per section in the remainder of the DFPA. Impacts to recreation would involve a temporary displacement of hunters, particularly during construction and drilling of 385 wells at 361 locations over 20 years. Some hunters perceive these activities as displacing game species and creating an environment that detracts from the hunting experience. Hunter displacement would be highest during the pronghorn season when most users are in the area. The proposed drilling schedule would displace hunters from an area or areas within the Desolation Flat project boundaries from 2003-2023, twenty hunting seasons. Hunter options to relocate to other hunting areas within the region are becoming increasingly constrained. The extent of oil and gas development in the region makes it difficult to find hunting opportunities in more natural settings where isolation and solitude persist. The Adobe Town WSA and MVMA are the largest and closest relocation possibilities with these characteristics. However, 23 square miles of the MVMA, 14 of which are on BLM administered property, are also included in the DFPA. The MVMA and WSA are generally higher in elevation than the DFPA. Hunters (or other recreationists) looking south and east could view oil and gas facilities and activities both within the MVMA and east of the WSA. The extent to which these would be visible would depend on specific siting of wells, roads, and other facilities, and the presence of fugitive dust. The level of disturbance to the visual resource and oil field activities could reduce the number of users. There are no areas in the region with the isolation and solitude characteristics of Adobe Town/Monument Valley to which hunters could relocate.

Undisturbed landscapes, isolation and solitude are often important to non-consumptive users such as photographers and back packers. Project related disturbances that adversely impact the characteristic landscape could also contribute to a decline in the recreation experience for these users. The recreation experience for those continuing to use the area would be less satisfying than use under the pre-disturbance conditions described in Chapter 3.

The affects described above would diminish once drilling and construction were completed in the area being drilled. However, they would persist at reduced levels for the next 30 to 50 years, particularly where well densities reach 4 wells per 640 acres.

Patterns of game use and population densities may change as a result of the project. Some long term displacement, permanent or relocation, of hunters and non-consumptive users would result. Further, there may be reduced levels of satisfaction for those recreationists who might continue to use the area. Overall impacts to the recreation resource, although substantial, would not be considered significant due to the short term nature of drilling and construction activities in any single area, sequential patterning of drilling activities during any one drilling season, and small number of recreationists affected in the long term.

MVMA and WSA

Impacts to recreation resources resulting from 13 wells in the MVMA would be considered significant because adjacent Adobe Town and MVMA are two of the few remaining areas in the region with landscape characteristics that provide isolation and solitude. There may be some displacement of users from other areas within the DFPA to more pristine landscapes such as the WSA and MVMA. However, as previously noted, 23 square miles of MVMA are also part of the project area, and depending on the intensity and location of development, the MVMA may not retain the level of isolation and solitude recreationists seek.

No drilling will occur in the WSA. However, drilling and production could occur along the 21 miles of common boundary interface between the WSA and DFPA. Well density along this interface could be at 4 wells per section in some locations. Noise, fugitive dust, and the industrial character of drilling and production would adversely impact the pristine WSA landscape diminishing the area's attributes of solitude and isolation sought by WSA recreationists. These activities would likely produce both short term and long term impacts to recreation resources in the adjacent WSA. Mitigation of noise, dust, and visual impacts via site selection or screening would be difficult given the character of the landscape along the interface between the WSA and DFPA.

4.9.3.2 Alternative A

Alternative A would consist of drilling 592 wells at 555 locations. Impacts to the recreation resource would be similar to those described for the Proposed Action. However, the increase in the number of well sites, associated roads, production facilities, and management activity would further diminish the sense of isolation and solitude valued by recreationists who visit the area. In addition, the increased number of well sites and related facilities would make it more difficult to find locations where natural screening would minimize impacts particularly where well site density reaches 4 wells per section. Long term impacts would also be substantially higher, due to the additional production wells and associated support facilities that would remain for the 30 to 50 year LOP. Several generations of recreationists could be affected. Adverse impacts to the recreation resource associated with Alternative A would be substantially higher in both the short term and the long term than the Proposed Action.

MVMA and WSA

Impacts to recreation resources in the MVMA would be similar to those described for the Proposed Action.

Impacts to recreation resources in the adjacent WSA could be more adverse than those described for the Proposed Action, a product of the increased number of proposed wells and support facilities.

4.9.3.3 Alternative B - No Action

The No Action Alternative would accommodate previously approved Mulligan Draw and Dripping Rock projects and may allow APD's and ROW actions to be granted by the BLM on a one well per section (Mulligan Draw and Dripping Rock) or a case-by-case basis through individual project and site-specific environmental analysis. Additional natural gas development could occur on State and private lands within the project area under APD's approved by the WOGCC. The potential impact on recreationists would depend on the number of APD's and ROW's granted, their location, and drilling schedule. With the greatly reduced number of wells, the impacts would be similar to, but of lesser magnitude than the Proposed Action.

MVMA and WSA

Impacts to the recreation resource associated with the No Action Alternative would be similar to those described for the Proposed Action but of lesser magnitude.

Impacts to the recreation resource in the adjacent WSA could be similar to those described for the Proposed Action but of lesser magnitude.

4.9.4 Impacts Summary

There would be no significant adverse impact to recreation resources if recommended mitigation measures are employed with the exception of the 23 square miles of project area inside the MVMA and along the 21-mile interface with the WSA. However, some users would be temporarily or permanently displaced and for some that continue to recreate in the area, the experience would be diminished. Several generations of recreationists could be affected.

MVMA and WSA

Drilling and possible production activities of 13 proposed well sites in the DFPA inside the MVMA could have significant adverse impacts to the future recreation potential; impacts would include surface disturbance, changes to general landscape character and visual resources. Future generations of recreationists would be denied the possibility of experiencing isolation and solitude afforded as part of a potential future special management area.

Also, drilling in the MVMA and along the 21-mile DFPA/WSA common boundary could preclude quality recreation opportunities for those seeking solitude and isolation within the northern and eastern portion of the adjacent Adobe Town WSA until all wells have been abandoned and fully reclaimed. This is considered a significant adverse impact. The MVMA is checkerboard land within the project area, the potential consequences as described above could add substantially to the level of adverse impact.

4.9.5 Additional Mitigation Measures

Given the measures proposed by the DFPA Operators (Section 2.5.2.11.2), which would reduce the level of impact; no additional mitigation measures are proposed. There are no additional mitigation measures that would lower the impact below a significant level for drilling activity in the MVMA and along the 21-mile DFPA/WSA common boundary.

4.9.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.9.3.

4.10 VISUAL RESOURCES

4.10.1 Introduction

Both short-term and long-term impacts to visual resources could be possible where patterns of area, line, form, color, and texture in the characteristic landscape could be contrasted by drilling equipment, production facilities, and/or construction related damage (e.g., roads, drill sites, pipelines) to vegetation, topography, or other visible site features. The severity of impact depends upon scenic quality, sensitivity level and distance zone of the affected environment, reclamation potential of the landscape disturbed, and the level of disturbance to the visual resource created by the Proposed Action and alternatives. In general, impacts would be most severe on sites where mitigation would be difficult and where visual contrasts would be highly visible to potentially large numbers of viewers.

4.10.2 Impact Significance Criteria

Visual impacts would be considered significant if the following condition were met:

- Non-compliance with the RMP directives in the long term for visual resources (VRM Class 2 and 3).

4.10.3 Direct and Indirect Impacts

4.10.3.1 Proposed Action

The following discussion assumes a non-uniform distribution of wells and support facilities across the landscape with a maximum density of four wells per section in any one location. As noted In Chapter 3, Affected Environment, the DFPA is not pristine, there are 63 existing wells and 259 miles of upgraded and resource access roads. Off road vehicle tracks which exist throughout the area are used occasionally by ranchers, recreationists and mineral developers. However, there are relatively fewer roads within that portion of the project area that is inside the MVMA. Short term impacts to the visual resource include surface disturbance associated with construction and drilling, and construction of new or upgrading of existing roads. Drilling-related impacts would alter existing landscape character producing contrasts in line, form, color, scale and texture. These contrasts would be associated with drilling rigs, construction equipment, service trailers and the general industrial character of drilling activities. Additional impacts may occur from fugitive dust produced by construction activities. The impacts described above would likely occur at various locations throughout the project area for the next 20 years. The affects would be additive, as new areas are being drilled, previously drilled sites, if producing, would be transformed into production status.

Few, if any, drilling sites would be visible from Wyoming Highway 789, the only major paved roadway in the region. However, some drill rig masts may be visible from the Dad area during drilling operations. Potential viewers of the contrasts previously described would be few in number and would include hunters and other recreationists, ranchers, and oil and gas field workers.

In the BLM's VRM rating system, the severity of impact is related to the scenic quality, sensitivity level, and distance zone of the affected environment. In general, short term impacts would be most severe where the level of contrast is high and highly visible in the foreground to potentially large numbers of viewers.

The short term impacts would exceed the level of contrast permitted in both Class 2 and Class 3 areas; however, because the contrasts would be seen by relatively few viewers and would be short in duration in any one area during a drilling season, they would not be considered significant. An exception to this would be the 23 square miles of project area located with the MVMA that is in the VRM Class 2 area.

Fixed facilities such as producing well sites, access roads and compressor stations would remain once well drilling activities were completed. These facilities would create contrasts in line, form, color, texture and overall pattern in the landscape and would remain for the 30 to 50 year duration of the project. Fugitive dust impacts as part of on-going operations would also persist. Levels of contrast would, in general, detract from the visual experience of those recreating in the immediate area. However, as noted for short term impacts, these contrasts would not be visible to many viewers. With appropriate mitigation, the level of contrast would not exceed Class 3 standards and therefore would not be considered significant.

MVMA and WSA

Impacts could exceed Class 2 standard for the 14 BLM administered sections of the project area rated as Class 2 included in the MVMA and could be considered significant depending on well density per section, well location and success of mitigation measures. Drilling in the 14 BLM administered sections within the MVMA would produce contrasts in line, form, color, and texture as previously described. These contrasts would likely persist although at reduced levels after drilling. The impacts in these sections would be considered significant if site disturbances were not reclaimed to VRM levels necessary for the 14 square miles to be considered for inclusion in a potential future ACEC. They could eliminate the opportunity for future generations of recreationists to experience the relatively undisturbed character of visual resources in these 14 sections. In addition, site disturbance and facilities would be visible from other portions of the MVMA and adjacent Adobe Town WSA, diminishing the quality of the visual experience for potential future users of these areas.

It should be noted that 9 square miles within the project area and the MVMA are privately owned. Drilling and potential production could proceed without application of BLM VRM standards or oversight. These activities could, and likely would have significant adverse impacts on the visual resources of adjacent BLM sections and the MVMA in general.

Fourteen public sections in the northwest quadrant of the DFPA are part of the Mulligan Draw Project Area. As precedent, one well per section was permitted in the MVMA (Class 2 VRM) as recorded in the Mulligan Draw ROD (USDI-BLM 1992b). Unregulated drilling activity on private sections could produce significant impacts to the visual resource on public land even if no wells

were drilled on public land. Wells drilled on private land may lead to a need for additional wells on public land to deal with drainage issues.

A visibility analysis was completed for the Monument Valley section of the DFPA. The analysis was done from a 2 track road that runs through T16N, R95W Sections 5-8 and 17 as requested by the BLM. The site is very open, sloping gradually toward the road. There are 4 small 'haystack' formations that produce 3 small triangular-shaped areas that would be seldom seen, two of these areas are on private land. Over 90% of the area would be visible from the 2 track road. Well densities (over 1 per section) in this type of setting would exceed Class 2 VRM standards if the Mulligan Draw Decision is a precedent reference. The generally open nature of the site and its slope toward the road would make it difficult to mitigate visual impacts. However, as noted elsewhere in this section, the number of visitors in this area presently is very low.

4.10.3.2 Alternative A

Impacts associated with Alternative A would be similar to those described for the Proposed Action. The approximately 54 percent increase in the number of potential exploratory well sites, associated roads, production facilities and management activity would further degrade the visual resource by increasing levels of visual contrast. However, impacts would not exceed levels of contrast permitted in Class 3 VRM areas. The increased number of well sites and related facilities would make it more difficult to find locations where natural screening would eliminate them from view. Adverse impacts to the visual resource associated with Alternative A would be substantially higher in both the short term and long term than those of the Proposed Action.

MVMA and WSA

Impacts associated with Alternative A to the visual resources in the MVMA and adjacent WSA would be more adverse than those described for the Proposed Action, a product of the increased number of proposed wells adjacent to the WSA, wells needed to deal with water issues, and support facilities.

4.10.3.3 Alternative B - No Action

No action would accommodate previously approved Mulligan Draw and Dripping Rock projects and may allow APD's and ROW's to be granted by BLM on a case-by-case basis. The potential impact on visual resources would depend on implementation of previously approved projects and the number of APD's and ROW's granted, their location, and drilling schedule. In terms of magnitude, such impacts would likely be considerably less than for the Proposed Action.

MVMA and WSA

Impacts associated with the No Action Alternative (well density/per section) would be the same as those described for the Proposed Action.

4.10.4 Impacts Summary

With the exception of the 23 square miles of project area inside the MVMA, there would be no significant adverse impact to visual resources in the DFPA if recommended mitigation measures are employed. However, some users would be temporarily or permanently displaced and for some

that continue to recreate in the area, the visual experience would be diminished because of dust and a general degradation of visual quality.

MVMA and WSA

Drilling in the 23-square mile MVMA area could preclude high visual quality recreation opportunities for those seeking solitude and isolation within the northwestern portion of the DFPA and adjacent Adobe Town WSA until all wells have been abandoned and fully reclaimed. Several generations of recreationists could be affected. This is considered a significant adverse impact.

4.10.5 Additional Mitigation Measures

With implementation of mitigation measures proposed in Section 2.5.2.11.2 no additional mitigation measures are required.

4.10.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.10.3.

4.11 CULTURAL RESOURCES

4.11.1 Introduction

Cultural resources on public lands, including archaeological sites and historic properties, are protected by various laws and regulations, for example the National Historic Preservation Act of 1966 (NHPA) and 36 CFR 800. The specific directives can be found in "Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines" (Federal Register 1983). Laws and regulations concerning cultural resources stipulate the proposed undertaking take into consideration the effects of the action to significant cultural resources. This requires that cultural resources within the proposed area of potential effect (APE) must be identified and evaluated. Measures would be taken to mitigate or minimize adverse effects to historic properties included in, or eligible for, the National Register of Historic Places.

The DFPA data base contains 900 known sites in a 234,880-acre area. Sites include prehistoric open camps consisting of habitation sites, camps with ceramics/pottery, camps with stone circles, camps with cairns, camps identified as milling/processing/ground stone sites, and camps with butchering/processing activity areas. The prehistoric lithic debris sites are categorized as lithic scatters, quarry sites, primary and secondary procurement sites.

The historic sites include the Cherokee Trail, a cabin, a mine, cairns, debris, and ranching/stock herding sites. Prehistoric/historic sites are grouped into prehistoric camps with stone rings and ranching activities, prehistoric camps with historic debris, lithic scatters with historic debris, lithic scatters with ranching/herding material. Of the recorded 900 sites, 24% are recommended eligible for nomination to the NRHP, 20% are recommended not eligible for nomination to the NRHP, and 56% remain unevaluated.

Potential impacts to specific eligible or unevaluated properties are unknown at this time. Only 365 projects have been conducted in the DFPA. The DFPA encompasses approximately 327 square miles or 233,542 acres. Approx.12,263 ac (block) or ca. 5% of the project area have been inventoried at Class III level for an approximate site density of 1 site per 14 acres. The overall site density within the project area varies with the highest number of sites located along drainages and near the major topographic land forms. Ephemeral drainages flow into the Washakie Basin from several escarpments such as Prehistoric Rim, Willow Creek Rim, and Powder Rim, flow into the major drainages of Skull Creek, Sand Creek, Willow Creek Windmill Draw, Shallow Creek, and Barrel Springs Draw along with their tributaries. Certain topographic settings have a higher archaeological sensitivity such as eolian deposits (sand dunes, sand shadows, and sand sheets), alluvial deposits along major drainages, and colluvial deposits along lower slopes of ridges.

4.11.2 Impact Significance Criteria

Mitigation of potential adverse effects is required for National Register listed sites and sites identified as significant and eligible for nomination to the National Register if there is no way to avoid those adverse effects. Significance is measured by four categories defined by the National Register (36 CFR 60.4):

> "the quality of significance in American history, architecture, archaeology, and culture present in districts, sites, buildings, structures and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association; and that:

- are associated with events that have made a significant contribution to the broad patterns of our history; or
- are associated with the lives of persons significant in our past; or
- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield information important in prehistory or history."

For archaeological sites, both prehistoric and historic, significance is primarily judged by the site's ability or potential to yield information important in prehistory or history and how that information will contribute to addressing local and regional questions, topics, and problems. The cultural resources within the DFPA can be evaluated with reference to these research objectives.

The BLM operates under the procedures promulgated under the National Historic Preservation Act (NHPA) at 36 C.F.R. 800 and/or the national programmatic agreement and statewide protocol to assess effects to sites deemed eligible for nomination to the National Register. Significant adverse effects to cultural resources may include:

- Destruction or alteration of all or part of a property.
- Isolation of a cultural resource from, or alteration of, its surrounding environment.

- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.

- Neglect and subsequent deterioration.

The preferred strategy of cultural resource management is avoidance of cultural properties identified as significant and the redesign, relocation, or cancellation of projects that pose adverse effects to significant cultural resources. If this strategy cannot be implemented, mitigation will ensue.

4.11.3 Direct and Indirect Impacts

4.11.3.1 Proposed Action

Adverse effects could be in the form of direct, indirect, or cumulative impacts. Direct impacts would primarily result from construction related activities and would be considered significant if lost information impeded efforts to reconstruct the prehistory or history of the region. Activities considered to have the greatest effect on cultural resources include blading of well pads and associated facilities, and the construction of roads and pipelines. Alteration of the environment abutting eligible historic properties (recommended under Criteria a, b, or c) may be considered an adverse effect in the form of a direct impact. Sites located outside the APE would not be directly affected by the construction activities. If the area of the site crossed by earth disturbing activities does not possess the qualities that contribute to the eligibility of the site, the project is judged to have no effect. Appropriate avoidance and other mitigation measures would be implemented to minimize the potential loss of information due to any adverse effects.

Indirect impacts would not immediately result in the physical alteration of the property. Indirect impacts to prehistoric sites primarily would result from unauthorized surface collecting of artifacts which could physically alter the sites. At historic sites this could include bottle collecting and the introduction of visual impacts.

Contributing segments of historic trails would be avoided by a ¼ mile buffer zone or within the visual horizon, whichever is closer. These actions are designed to provide protection for the historic trail corridors.

4.11.3.2 Alternative A

Potential impacts to prehistoric and historic properties under Alternative A would be similar to the Proposed Action but of a greater magnitude due to potentially more site disturbance. These impacts are expected to increase on private surfaces under this alternative.

4.11.3.3 Alternative B - No Action

Under the No Action Alternative, the Proposed Action would not be implemented and further drilling would be allowed on federal lands to the extent that it would be within the scope of existing environmental analyses (i.e. Mulligan Draw and Dripping Rock decisions) and individual APD's that would be approved on a case-by-case basis. In terms of magnitude, such impacts would likely be considerably less than for the Proposed Action.

4.11.4 Impacts Summary

Gauging the effect of any impact depends on the level of information available for that particular property provided by inventory and/or testing data. If cultural resources on, or eligible to, the National Register are to be adversely impacted by the proposed undertaking, then the applicant, in consultation with the surface managing agency and the SHPO, shall develop a mitigation plan. Construction would not proceed until terms of the mitigation plan are satisfied.

4.11.5 Additional Mitigation Measures

With implementation of mitigation measures proposed in Section 2.5.2.11.2 (Cultural Resources), no additional mitigation measures are needed.

4.11.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.11.3.

4.12 SOCIOECONOMICS

4.12.1 Introduction

Implementation of the two action alternatives would result in socioeconomic effects including: (1) increased employment and activity in the local, regional and national economy; (2) additional tax revenue for federal, state, and local governments; and (3) incremental demand for housing and public services in small communities and unincorporated areas near the DFPA. Both action alternatives also have the potential to affect attitudes and opinions regarding the use of public lands and to create dissatisfaction for some hunters, recreationists and other individuals and organizations who believe that public lands within the MVMA should be left in their relatively undisturbed state.

Many of the socioeconomic effects associated with the action alternatives could also occur under Alternative B (No Action), because previously approved wells and wells approved on a case-by-case basis would be developed. As with the action alternatives, the magnitude of the impacts would depend on the pace and level of development that actually occurs.

Development of the natural gas resources within the DFPA would involve multiple operators. The pace and timing of drilling and field development would depend on a variety of factors including national and international energy demand and resultant commodity prices, actual production experience within the DFPA and each company's development initiatives and strategies. Because the pace and timing of development cannot be predicted with certainty, this assessment assumes a relatively constant rate of development, based on the drilling of an annual average number of wells (i.e., total number of wells proposed divided by the 20-year development cycle).

Historically, drilling and field development in southwest Wyoming has been cyclic rather than constant. Moderate cyclic increases and decreases in drilling and field development activity would not result in impacts substantially different from those identified in this section. However, a

substantial and sustained increase in natural gas demand and price, resulting from unforseen circumstances (e.g., world events, changes in national energy policy or sustained high economic growth), could result in a dramatic increase in the pace of development and impacts greater than those identified in this section. Such circumstances would affect development of natural gas resources throughout southwest Wyoming and are discussed in the cumulative socioeconomic assessment contained in Section 5.3.12.

4.12.2 Impact Significance Criteria

The following criteria are used to determine whether socioeconomic impacts of the Proposed Action and alternatives would be significant:

- an increase in county or community population that would strain the ability of affected communities to provide housing and services or otherwise adapt to growth-related social and economic changes;

- an aggregate change in revenue and expenditure flows likely to result in an inability on the part of affected units of government to maintain public services and facilities at established service levels;

- permanent displacement of residents or users of affected areas that would result from project-induced changes in or conflicts with existing ways of life;

- levels of project-induced dissatisfaction likely to generate organizational response and conflict.

4.12.3 Direct and Indirect Impacts

4.12.3.1 Proposed Action

4.12.3.1.1 Economic Effects

The Proposed Action, as described in Chapter 2 of this assessment, would involve an estimated $840 million capital investment for drilling, completion, gathering systems and field infrastructure. This investment would occur over 20 years.

Development and operation of the Proposed Action would require goods and services from a variety of local and regional contractors and vendors in the oil and gas service industry and other industrial sectors. Expenditures by the proponents for these goods and services, coupled with employee and contractor spending, would generate positive economic effects in southwestern Wyoming, the State of Wyoming and the nation as a whole.

The University of Wyoming Agricultural Economics Department has developed an input-output economic model specifically for southwest Wyoming. The model maps the flow of dollars through the region's economy and provides information about the interaction of individual sectors within the regional economy. The model considers both the direct effects on the producing sector(s) of a change in economic activity and the secondary effects on other local sectors due to the linkages within the region's economy. The model was used for the socioeconomic portion of the BLM's Southwest Wyoming Resource Evaluation (UW 1997) and has been updated for the Desolation Flats assessment.

The model and other elements of this assessment are based on the following assumptions:

- Drilling and field development in the DFPA would occur over 20 years, during which 385 wells would be drilled with a success ratio of 65 percent, yielding 250 producing wells.

- An average of 19 wells would be drilled each year and an average of 12.5 of these would be productive; the average life-of-well production would total as much as 5BCF;

- Each well would require an average of $1.5 million to drill and an additional $1.05 million to complete.

- Revenues and expenditures are expressed in terms of constant 2001 dollars, except for annual average well head gas prices, which are based on the most recent US Department of Energy forecasts ($2.79/MCF in 2002, falling to $2.49/MMCF by 2004 increasing thereafter to $4.53 by 2041) (DOE 2000). DOE estimates are in 1999 dollars, which were converted to deflated 2002 dollars for use in the UW model.

Use of the foregoing assumptions and the UW model allow a reasonable assessment of the potential socioeconomic impacts of the Proposed Action and alternatives, however, economic effects of the Proposed Action would be different than those forecast by the model if actual conditions vary substantially from these assumptions.

Estimated economic effects of drilling and field development are displayed in Table 4-19 Based on the foregoing assumptions, the UW model estimates that an annual average direct expenditure of about $40 million would result in an annual economic impact (direct and indirect) of about $54.5 million in southwest Wyoming, or a total economic impact of $1.145 billion over the 20-year drilling cycle. Note that the Proposed Action contains a 20-year elapsed-time drilling schedule, but completion and field development activities are assumed to occur in portions of 21 calendar years.

The model also estimates that annual drilling and field development earnings in southwest Wyoming would be $7.3 million or about $154 million total over 20 years. These earnings would support an average of 246 annual job equivalents (AJE).

Table 4-19. Estimated Economic Effects Associated with Drilling and Field Development: Proposed Action

	Direct Expenditures	Total Economic Impact	Total Earnings	Employment (AJE, direct & indirect)
Average Annual	$40 million	$54.5 million	$7.3 million	246
Total	$840 million	$1.145 billion	$154 million	n/a

Source: UW 2001

Job estimates include direct and indirect; AJE denotes annual job equivalents.

Estimated economic effects associated with production are presented in Table 4-20 The life of the Proposed Action is projected to be 30 to 50 years. For the socioeconomic assessment, a 40 year production cycle is assumed. Based on the assumptions outlined in the earlier part of this assessment, natural gas and condensate production would result in over $2.97 billion in economic impact over the 40 year production cycle, and in an average annual payroll of $5.5 million supporting156 annual average job equivalents. Production-related jobs (direct and indirect) begin at an estimated 36 in 2003, increase to 90 in 2004 and then steadily increase to a peak of 280 in 2022, at which point they begin to decrease. Production-related jobs would be distributed throughout southwest Wyoming.

Table 4-20. Estimated Economic Effects Associated with Production

	Value of Production	Total Economic Impact	Total Earnings	Employment (AJE, direct & indirect)
Average Annual	$56.6 million	$74.4 million	$5.5 million	156
Total	$2.265 billion	$2.977 billion	$218.4 million	n/a

Source: UW 2001

As shown in Table 4-21, the combined drilling, field development and production phases of the project would generate an estimated $4.122 billion in total economic impact to southwest Wyoming, including $372 million in total payroll over the 40 year LOP used for this assessment.

Table 4-21. Estimated Total Economic Impact: Drilling, Field Development and Production

	Total Economic Impact	Total Earnings
Total	$4.122 billion	$372 million

Source: UW 2001

Implementation of the Proposed Action would substantially increase natural gas production in Sweetwater and Carbon counties. Under the assumptions used for this assessment, annual gas production would total 16 million MCF in 2004, increase to 50.5 million MCF in 2022, and then gradually decrease to about 10 million MCF in 2042 (Figure 4-9). By comparison, Sweetwater and Carbon County natural gas production in 1999 totaled 224 million MCF and 80 million MCF respectively. At the volumes assumed for this assessment, over 1.1 trillion cubic feet of natural gas would be produced over the 40 year production cycle.

Additionally, each Desolation Flats well is estimated to produce an annual average of 1,000 barrels of condensate. Condensate volumes are projected to increase from a 2004 total of about 32,600 barrels to a peak of about 101,000 barrels in 2022 and decrease to about 21,000 barrels in 2042. Over the 40 years, condensate volumes would total an estimated 2.26 million barrels.

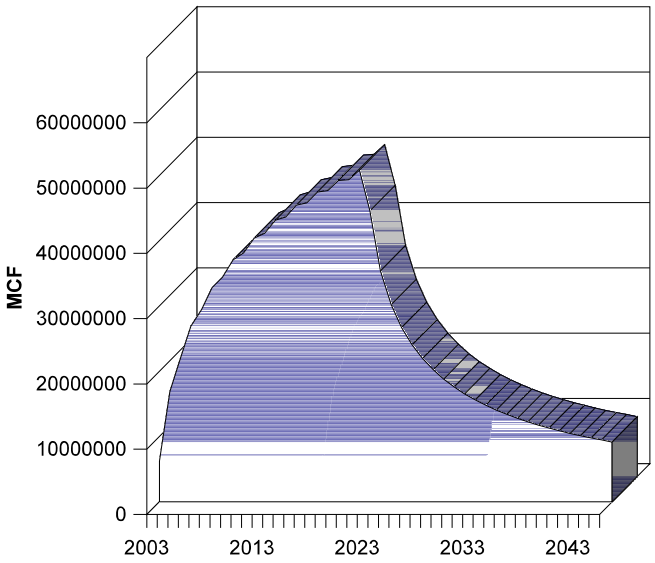
In 1999, APD's (drilling permits) issued for Sweetwater and Carbon counties totaled 123 and 127, respectively. The average annual level of 19 wells assumed for the Proposed Action would equal about 8 percent of the combined two-county total for 1999.

4.12.3.1.2 Effects on other Economic Activities in the Vicinity of the Proposed Action

As outlined in Section 3.11, existing land uses in the vicinity of the Proposed Action include wildlife habitat, grazing, hunting and other dispersed recreation, and oil and gas exploration, production and transmission.

Potential impacts to grazing activities and range resources are discussed in Section 4.6. Economic effects of the Proposed Action on grazing activities would include losses of forage due to temporary and long-term disturbance. As described in Section 4.6.1, disturbance would result in the loss of an average annual of 170 AUM's or a total of 6,796 AUM's over the 40 year assessment period.

Figure 4-9. Proposed Action: Estimated Total Annual Gas Production: 2002 - 2045



Source: UW 2001; Marathon Oil Company 2000

If these AUM's are not replaced in other allotments, the associated economic activity in Sweetwater and Carbon counties would also be lost. A recent UW study estimated that each AUM of cattle grazing was worth $65.07 in total economic impact in the region, and resulted in $11.81 in earnings and .000710 jobs. Each AUM of sheep grazing was worth $41.16 in regional economic impact, $8.99 in earnings and generated .000639 jobs (UW 2000). Using the higher figures for cattle, implementation of the Proposed Action would result in a loss of $442,000 in total economic activity and $80,000 in total earnings over the 40 year LOP. The proposed action would also result in loss of an annual average of 0.1 jobs. Changes in livestock commodity prices would yield different loss estimates.

According to the recreation assessment contained in Section 4.9, some hunters and other recreationists may be temporarily displaced from the area by drilling and field development activity and land disturbance. A lesser number of hunters and recreationists may be displaced long-term because of the loss of undisturbed landscapes and solitude. The above-referenced UW report provided estimates of per/day total regional economic impacts from recreation, which range from

a high of $331 per day for elk and antelope hunting to a low of $81 per day for non-consumptive recreation uses. For these same activities, regional earnings associated with various recreation activities range from $47 per day for elk hunting to $13 per day for non-consumptive recreation, and regional jobs range from .003 for elk and antelope hunting to .001 per day for non-consumptive recreation. In addition to these expenditure-related economic effects, the UW study estimated economic benefits to individual recreational participants, known as net economic value. The net economic values of hunting were estimated at $41.46 per day and $26.57 per day for non-consumptive recreation uses (UW undated).

Estimates of the number of recreationists who use the DFPA are not available. Estimates of the number of hunters and other recreationists who would be displaced temporarily or long term by the Proposed Action are similarly not available. Some new recreationists may be attracted to the area by the increased accessibility resulting from road construction (USDI-BLM 1999a); estimates of potential new users are also not available. Since overall recreational use levels in the DFPA are generally low, the economic effects of displaced hunters and recreationists on the Sweetwater and Carbon county economies would be correspondingly low. There is also some potential that displaced hunters and recreationists may relocate to other areas within southwest Wyoming offsetting a portion of the loss of economic activity, although opportunities for relocating to relatively undisturbed areas are becoming increasingly limited.

4.12.3.1.3 Employment and Population Effects

Population effects of the Proposed Action would be linked to both direct and indirect employment. Direct jobs are defined as jobs in the oil and gas service or construction sectors involving work on some aspect of the project. Indirect jobs are created by company and employee spending for goods and services, and would occur in all economic sectors. As a result of the Proposed Action, both direct and indirect jobs would be created throughout southwest Wyoming, but concentrated in Rock Springs, which has emerged as a regional oil and gas service center.

The average annual 246 drilling and field development and 156 production-related jobs (direct and indirect) estimated by the UW model are AJE. AJE jobs reflect an aggregation of all employees whose employment is supported in part by Desolation Flats project spending.

The distinction between AJE jobs and the number of employees who may work occasionally on Desolation Flats project activities is useful in the assessment of potential population impacts associated with the Proposed Action, and to the determination of the distribution of that population. For example, an estimated 103 AJE or 42 percent of the total 246 drilling and field development employment associated with the Proposed Action would be in oil and gas field services. Drilling and completing a natural gas well involves a number of distinct activities that are carried out by specialized contractors who are on site for a variable amount of time. Some contractors such as surveyors and archeologists are on site for a day or less per well, others such as mud loggers, engineers and vendors are on site once a week or every several days throughout the drilling cycle. Still others such as drill crews may be on site every day for 50 or 60 days, depending on the length of time it requires to reach the drilling target. Vendors, BLM and other regulatory personnel, truck drivers and delivery persons visit wells briefly. They are included in the AJE estimates presented above, but are not included in the drilling employment estimates shown in Figure 4-10.

In a multiple operator situation such as the Proposed Action, an oil and gas service firm employee may work for several days on a Desolation Flats well and then relocate to a well in a different part

of the region. Although many workers would perform work in the DFPA, few would work there full-time for extended periods.

An employee of an oil and gas service company is likely to live near his or her employer. Because the greatest number of oil and gas service firms are located in Rock Springs, the employee is most likely to live in the Rock Springs area. Fewer numbers of employees would live in Rawlins, given the smaller number of oil and gas service firms located there. Even fewer employees would be likely to establish long-term residences in Wamsutter or the Baggs area, even though the DFPA is located nearer to these communities.

However, some contractor employees would seek temporary housing (motels and RV park spaces) in nearby communities during the time they are working in the DFPA. Consequently, it is useful to estimate the numbers of workers who might be working in the DFPA, both on a monthly average and peak daily basis.

Because multiple operators hold leases in the DFPA, well drilling schedules within any given year cannot be predicted. Simulations of daily employment for each well and of a 19 well drilling schedule were used to provide estimates of monthly wellfield employment levels over the course of a year.

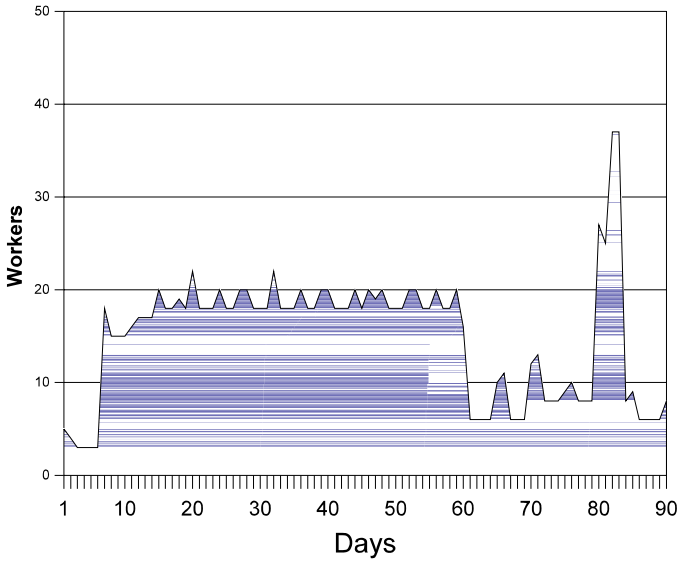
Figure 4-10 displays simulated drilling and completion employment levels associated with a typical DFPA well. Based on this simulation, employment would average 15 workers during the first month of drilling, 19 during the second month and 11 during the third month or completion phase for successful wells. Peak employment days during these months are estimated at 22, 22 and 37 workers respectively, under the assumptions used for this simulation. Events and circumstances could make both averages and peaks somewhat higher or lower than those used in this simulation. Simultaneous drilling of two or more wells by any one company would result in slight workforce reductions because certain contractors and company personnel could perform tasks on several wells during the course of a day.

Figure 4-11 displays a simulation of the monthly drilling and completion employment in the project area during a year, assuming an average number of 19 wells per year. Based on this simulation, drilling employment would peak in August at a monthly average of 131 workers. Daily averages during August and September could peak as high as 194 workers if peak days at several wells were to coincide. Drilling is assumed to diminish from mid-November through the end of July in areas where there are wildlife concerns. In some portions of the DFPA, drilling could diminish or even cease during March through June because of muddy conditions.

Four compressor stations are assumed to be constructed under the Proposed Action. Total employment during periods when compressor stations are constructed would be increased by an estimated 12 workers for an estimated 7 days. Similarly, one processing plant is assumed for the Proposed Action. During the period when the processing plant is constructed, total employment would be increased by 24 workers for an estimated 21 days.

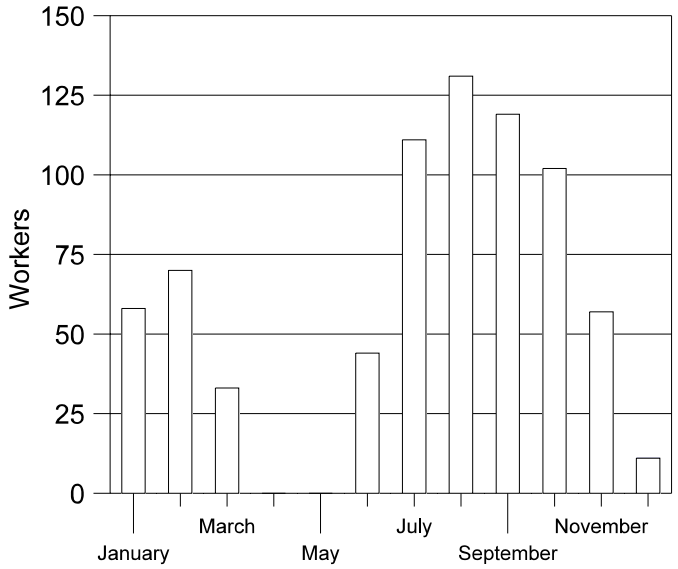
Once wells are drilled, completed and placed in service, it is estimated that wellfield operations would require less than 20 workers, although workovers and other maintenance activities would require additional contractors on an intermittent basis. An estimated three workers would require seven days to reclaim each well site and access roads if wells are unsuccessful or when gas reservoirs are depleted and wells are taken out of service.

Figure 4-10. Simulated Daily Drilling and Completion Employment: (One Well)



Source: Marathon Oil Company, 2000

Figure 4-11. Simulated Monthly Average Drilling and Completion Employment (19 Wells/Year)



Source: Blankenship Consulting LLC

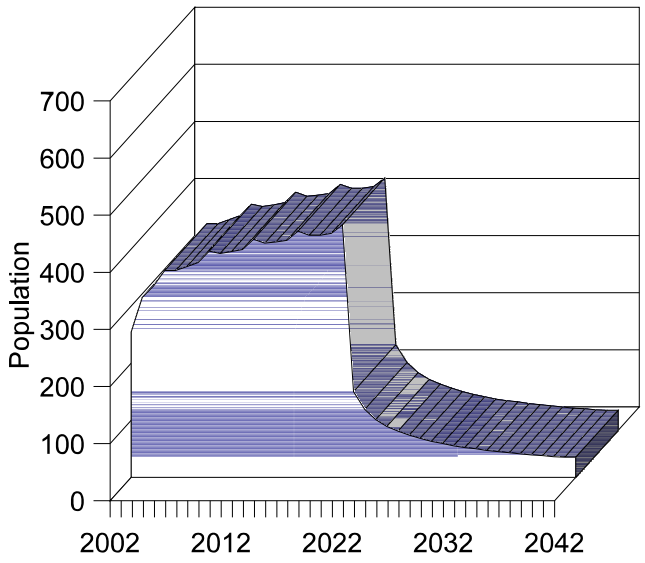
Some of the jobs created by the Proposed Action may be filled by existing residents of southwest Wyoming, resulting in no incremental population growth. Other jobs may be filled by persons who live outside southwest Wyoming at the time they are hired. A portion of this latter group would relocate to southwest Wyoming in a single status, others may bring their families.

It is likely that most direct jobs associated with the Proposed Action would be filled by non-local workers. A consequence of the recent increase in natural gas drilling activity throughout the state and elsewhere in the nation is that demand for skilled oil and gas service workers exceeds the current supply. Recent southwest Wyoming NEPA assessments have assumed that 50 to 55 percent of direct workers would be non-local. For this assessment, it is assumed that 80 percent of all oil and gas services jobs would be filled by workers outside the area.

Conversely, it is likely that most indirect jobs would be filled by local workers. As discussed in Section 3.11, a recent report identified 4,900 underemployed workers in Sweetwater and Carbon counties. These workers would be candidates for indirect jobs. Jobs vacated by underemployed workers would likely be filled in large part by unemployed workers and existing residents not currently in the workforce. Consequently, this assessment assumes that 90 percent of the non-oil and gas services jobs associated with the Proposed Action would be filled by workers currently living in southwest Wyoming.

Based on these assumptions, it is estimated that the in-migrant population associated with Proposed Action would total 255 persons in 2003, increasing annually to a peak of 442 in 2022 and decreasing steadily thereafter. Figure 4-12 displays Proposed Action-related in-migrant population estimates over the life of the project. The figure illustrates the substantial reduction in Proposed Action-related population which would occur at the end of the 20-year drilling and field development cycle. This population may leave or stay in southwest Wyoming, depending in large part on economic conditions and job opportunities at that time.

Figure 4-12. Estimated In-migrant Population Associated with the Proposed Action



Source: Blankenship Consulting LLC based on UW employment estimates.

Current population projections available from the Wyoming Division of Economic Analysis show slight population losses over the next six years for both Sweetwater and Carbon counties. In the absence of other development, the population increases associated with the Proposed Action may reduce near-term population losses in both counties.

The population associated with the Proposed-Action would be distributed throughout southwest Wyoming, but concentrated in Rock Springs and to a lesser extent, Rawlins. A relatively small number of oil and gas service firms are located in Wamsutter and Baggs; these companies may hire non-local workers if they obtain contracts for work in the DFPA.

4.12.3.1.4 Housing Demand

The Proposed Action would create demand for long term housing (houses, apartments and mobile homes and spaces in mobile home parks). Based on the assumptions used for this assessment, long term housing demand associated with the Proposed Action would total about 100 units in 2003, increasing to a peak of about 160 units over the next ten years. This demand could be accommodated in Rock Springs and Rawlins with existing housing resources. The Wamsutter and Baggs areas could also accommodate a small portion of this workforce with existing housing resources, although DFPA workers would have to compete with other oil and gas industry workers for the limited housing resources in these communities.

The Proposed Action would also generate demand for temporary housing. A portion of the project drilling, completion and field development workforce would return to a place of residence each night, and some drilling contractors may elect to establish temporary work camps at the drill site.

Other drilling and completion crews would be in the area for one or two months and would seek temporary housing. Although these workers would prefer to secure temporary housing (primarily apartments, motel rooms or mobile home and recreational vehicle park spaces) as close to the DFPA as possible, they would be competing for these limited resources with other area oil and gas workers, at least in the near term. Consequently, most would be required to travel to Rock Springs, Rawlins or the Colorado community of Craig to secure temporary housing accommodations. At present, these communities have adequate temporary housing resources to accommodate Proposed Action-related demand.

4.12.3.1.5 Community Facilities, Law Enforcement and Emergency Management Services

The relatively small incremental population associated with the Proposed Action would not strain most community facilities in Sweetwater or Carbon counties or the communities of Rock Springs or Rawlins. Population levels in these counties and communities remain substantially below the peak levels of the 1980's. Most public facilities have been sized to accommodate larger populations and would be able to accommodate this relatively small population increment, although there are exceptions. For example, both Sweetwater and Carbon counties are planning to replace currently inadequate jail facilities, for capacity and programmatic reasons. Additionally, any population increment could contribute to the need for additional county, municipal and school district staff and equipment in areas that are experiencing natural gas-related growth, such as Wamsutter and Baggs. In the case of the counties, the Proposed Action would generate substantial tax revenues (see Section 4.12.3.1.6.3) which could be used to fund demand for additional staff and equipment.

The situation is different for the towns of Wamsutter and Baggs. Public services in Wamsutter are already strained as a result of large drilling programs in the area, and the town is currently preparing a plan to increase housing and expand its public facilities (Rawlins Daily Times 2001). In the near term, few project workers would be able to find housing in Wamsutter. If additional housing is developed, the Proposed Action, along with the general increase in drilling and field development activity in the area (see Section 5.12), would contribute to increased demand for expanded public services in the Town. Unlike the larger communities, which receive substantial sales and use tax, and counties, which also receive property taxes, smaller towns receive little direct tax revenue from natural gas development.

Currently, the Town of Baggs is able to accommodate the seasonal influx of workers which fills its temporary housing resources. If additional housing resources are developed, or if a substantial number of oil and gas service contractors and their employees were to relocate to the area on a long term basis, some community facilities could be strained. As with Wamsutter, the Town of Baggs would receive little direct tax revenue from the Proposed Action.

Law enforcement and emergency management services in the DFPA are provided by Sweetwater and Carbon county sheriff's officers and by volunteer fire and ambulance organizations located in Wamsutter or Baggs. Taken in isolation, the level of development contemplated by the Proposed Action could be accommodated by existing law enforcement and emergency management resources. However, given the anticipated near-term increase in drilling and field development in the area, law enforcement and emergency service agencies may need to expand their capabilities to provide adequate coverage in areas experiencing natural gas development (Section 5.12). Sweetwater and Carbon county governments would receive substantial project-related tax revenues which could be used to help fund increases in law enforcement and emergency management services, although project-generated revenues may lag project-related demand for services.

Wellfield traffic in and near the project area would result in increased demand for maintenance on county roads. Proposed Action-related traffic would contribute to the already substantial maintenance requirements on the Wamsutter/Dad Road (SCR 23/CCR 701) and to maintenance needs on CCR 700. Project-related ad valorem and sales and use tax revenues generated to the counties should be adequate to fund increased maintenance requirements, unless substantial project-related road maintenance demand occurs before production-related revenues begin to accrue to the counties.

4.12.3.1.6 Fiscal Effects

The Proposed Action would generate substantial tax revenues including:
- local ad valorem property taxes on production and certain field facilities;
- sales and uses taxes on materials, supplies and equipment;
- Federal Mineral Royalty payments; and,
- Wyoming State severance taxes.

4.12.3.1.6.1 Ad Valorem Property Taxes

The Proposed Action would generate ad valorem property tax to Sweetwater and Carbon counties, the Wyoming School Foundation Fund, school districts and a number of special taxing districts within each county. Ad valorem property taxes would be generated from two sources: (1) the fair

market value of natural gas and condensate produced and sold; and (2) the value of certain wellfield and production facilities (underground facilities associated with wells are exempt).

Constant 2000 mill levies were used to prepare ad valorem property tax estimates. In reality mill levies are set each year by the county commissioners and officials of the various taxing districts; most change each year. Mill levies reflect the revenue needs of the taxing entity and estimates of assessed valuation within the entity. Natural gas is assessed based on the previous year's production. Wellfield facilities are depreciated after the first year of production.

Table 4-22. Displays estimated ad valorem property tax revenues to major property taxing entities in each county.

Under the assumptions used for this assessment, ad valorem property tax revenues from production and facilities would total almost $139 million over the 40 year life of the project.

4.12.3.1.6.2 Federal Mineral Royalties and Wyoming Severance Taxes

The federal government collects a 12.5 percent royalty on the fair market value of gas produced from federal leases, less production and transportation costs. Half of mineral royalty revenues are returned to the state where the minerals were produced. In Wyoming, a portion of the state's share is distributed to local governments and to the Wyoming School Foundation Fund.

The State of Wyoming collects a six percent severance tax on the fair market value of natural gas produced within the state. Federal mineral royalty payments and production and transportation costs are exempt from this tax. The state distributes revenues from this fund to a variety of accounts including the General Fund, Water Development Fund, Mineral Trust Fund, and Budget Reserve, and distributes a portion (one percent) to counties and municipalities.

Table 4-22. Total Estimated Ad Valorem Property Tax Revenues

Sweetwater County	School District U-1	State & Cty Schools	Total County	Weed & Pest	Communit y College	Total
Total (40 year)	$51,014,000	$36,010,000	$24,007,000	$852,000	$11,325,000	$123,208,000
Average Annual	$1,275,000	$900,000	$600,000	$21,000	$283,000	$3,080,000
Carbon County	**School District U-1**	**State & Cty Schools**	**BOCES**	**Total County**	**Weed & Pest**	**Total**
Total (40 year)	$6,820,000	$4,910,000	$273,000	$3,274,000	$273,000	$15,550,000
Average Annual	$170,000	$123,000	$7,000	$82,000	$7,000	$389,000

Note: Table does not breakout all special districts.

Source: Blankenship Consulting LLC

Estimated mineral royalty and severance tax revenues are displayed in Table 4-23. Actual mineral royalty and severance tax revenues would vary based on production levels, gas sales prices, and production and transportation costs. Actual severance tax revenues may be less than these estimates if a portion of the gas is used for production purposes. Actual federal mineral royalty collections may be less if a substantial portion of the production is drawn from state leases.

Table 4-23. Federal Mineral Royalty and Wyoming Severance Tax Estimates

	40 Year Total	Average Annual
Federal Mineral Royalties	$283,259,000	$7,081,000
Wyoming Share of Federal Mineral Royalties	$141,629,000	$3,541,000
Wyoming Severance Taxes	$118,969,000	$2,974,000

Source: Blankenship Consulting LLC

4.12.3.1.6.3 Sales and Use Tax

Wyoming collects a four percent sales and use tax on the gross receipts of sales of tangible goods and certain services (drilling services are exempt). The state returns 28 percent of the revenue (less administrative costs) to the county where the taxes were collected. Counties distribute the revenues to incorporated municipalities based on population. Both Sweetwater and Carbon counties also levy a one percent local optional sales and use tax which is distributed to the county and its municipalities. Carbon County recently retired an additional one percent capital facilities sales and use tax. The County may ask voters to approve the capital facilities tax again in 2003. If approved, the Carbon County sales and use tax rate would increase to six percent and additional project-related revenues would flow to the counties and incorporated municipalities.

During the drilling and completion phase of the Proposed Action, an estimated $185 million would be spent for goods and services subject to state and local sales and use taxes. Table 4-24 displays the state and local revenues which would flow from these expenditures, assuming that all sales and use tax payments are appropriately credited to Sweetwater and Carbon counties. Total sales and use tax revenues over the 20-year drilling cycle would be $9.3 million dollars. Of the total, an estimated $ 5.3 million would be distributed to the State of Wyoming, $3.45 million to Sweetwater County and $471 thousand to Carbon County.

4.12.3.1.6.4 Total Revenues

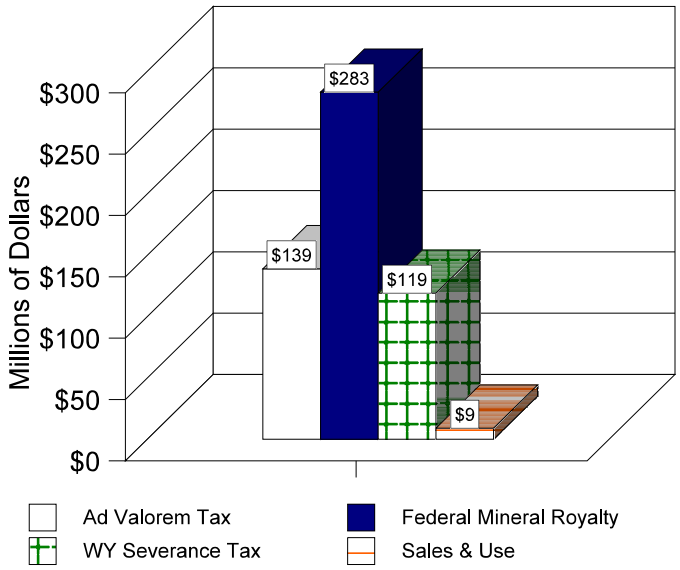
Figure 4-13 summarizes the estimates of tax and royalty revenues which would flow from the Proposed Action from the foregoing sources. The revenues are based on production, gas sales prices, tax rates and exemption estimates, all of which are subject to change as development proceeds. In addition to these revenues, other revenues would be associated with the Proposed Action including sales and use tax payments for ongoing operations of the project and from employee and vendor spending, Oil and Gas Conservation charges, and federal income tax payments by the proponent and its employees. These revenues have not been estimated for this assessment.

Table 4-24. Estimated Sales and Use Tax Revenues and Distributions

	State of Wyoming					
Total	$5,338,000					
Average Annual	$254,000					
	Sweetwater County Total	**County Share**	**Rock Springs**	**Green River**	**Wamsutter**	**All Other Towns**
Total	$3,458,000	$584,000	$1,720,000	$1,085,000	$24,000	$45,000
Average Annual	$165,000	$28,000	$82,000	$52,000	$1,000	$2,000
	Carbon County Total	**County Share**	**Rawlins**	**Baggs**	**Dixon**	**All Other Towns**
Total	$471,000	$81,000	$257,000	$10,000	$2,000	$120,000
Average Annual	$22,000	$4,000	$12,000	$500	$100	$6,000

Source: Blankenship Consulting LLC

Figure 4-13. Total Ad Valorem Property Tax, Federal Mineral Royalty, Severance Tax and Sales and Use Tax Revenues Associated with the Proposed Action



Source: Blankenship Consulting LLC

Federal, state and local government revenues from these sources would total an estimated $550 million over the forty-year life of the project.

4.12.3.1.7 Local Attitudes and Opinions

Sweetwater and Carbon counties have relatively long histories of oil and gas development, consequently residents are familiar with natural gas industry activities and their economic benefits. The combination of familiarity and anticipated economic benefit creates a climate of general community acceptance of and support for continued oil and gas development in Sweetwater and Carbon counties. Within this general climate of acceptance are resident attitudes and values that may diminish support or create opposition for a particular development proposal. These attitudes and values include concern for use of public lands and preservation of wildlife habitat and recreation resources.

These attitudes and values are evident in a number of the comments submitted in response to the DF scoping notice. Additionally, a discussion of these attitudes and values, as expressed by Carbon County residents, is included in the findings of the 1996 resident survey conducted for the Carbon County Land Use Plan (discussed in Section 3.12.7).

According to the Carbon County Land Use Plan, resident response to the survey suggests “a need to balance the conservation of natural resources and the economic viability of resource-based industries in the county.” This sentiment coupled with partial support for leasing more federal lands for oil and gas development (about 50 percent countywide, somewhat higher in every community but Rawlins and Saratoga) suggests that development of natural gas resources on existing leases would be generally supported by residents of Carbon County, as long as they perceive that such development does not damage wildlife habitat, or degrade the quality of recreation resources in the area.

Although no similar survey has been conducted for Sweetwater County (Kot 2000), it is reasonable to assume that some Sweetwater County residents hold similar attitudes concerning oil and gas development, recreational resources and wildlife habitat, although the numbers of residents holding each view in Sweetwater County may vary from those in Carbon County.

The recreation analysis conducted for this assessment concludes that implementation of the Proposed Action would result in substantial impacts to the recreation resource, but the impacts would not be considered significant due to the short term nature of drilling and construction activities (at any one well location), the sequential pattern of drilling activities during any one drilling season and the small number of recreationists affected in the long term (Section 4.9.4). An exception to this conclusion concerns the portion of the DFPA which lies within the MVMA, and the potential that the relatively unaltered landscape and opportunities for isolation and solitude in this area would be foregone over the long term.

Based on these conclusions, it is likely that the Proposed Action would receive general support in Sweetwater and Carbon counties, but some population segments would experience negative effects. Population segments who would be dissatisfied with the Proposed Action include those hunters and other recreationists who use the DFPA and feel that the hunting or recreation experience would be diminished by changes in game patterns or changes in the undisturbed landscapes, isolation and solitude. Individuals and organizations who believe that the relatively

undisturbed landscapes within the MVMA should be left in their current condition would also be dissatisfied.

Livestock operators who hold permits within the DFPA may also experience dissatisfaction with the Proposed Action if conflicts between grazing and drilling and field development activities arise. Opportunities for conflict would be substantially reduced once drilling and field development is completed.

It is also possible that broader levels of dissatisfaction with the Proposed Action could occur if area residents perceive that impacts to wildlife habitat or recreation resources are greater than anticipated.

4.12.3.2 Alternative A

Alternative A would involve the drilling of 592 wells at 555 locations, a 54 percent increase over the number of wells in the Proposed Action. For the Alternative A assessment, all other assumptions (20-year drilling schedule, 65 percent success ratio, production volumes, LOP, product prices, etc.) remain the same as those used for the Proposed Action. Consequently, economic, population and fiscal effects of Alternative A would all be roughly 54 percent higher than those associated with the Proposed Action.

During the drilling cycle, an annual average of 28.2 wells would be drilled, and 18.3 would be completed. Total direct expenditures for drilling and completion would increase to an estimated $1.292 billion, or an average annual expenditure of $61.5 million. These expenditures would create an estimated total economic impact of $1.762 billion in southwest Wyoming, with an average annual impact of $83.9 million over the 20-year drilling cycle. Alternative A would result in an estimated total $236 million in earnings, or an annual average of $11.2 million, which would support annual average direct and indirect employment of 378 AJE.

The economic effects of Alternative A-related production would include an estimated $3.487 billion dollars in total production, which would generate a total economic impact of $4.584 billion in southwest Wyoming, or an annual average of $114.6 million over the 40 year production cycle. Total production-related earnings are estimated at $336 million, or an average annual of $8.4 million which would support annual average direct and indirect employment of 241 AJE.

Combined economic effects of drilling and production are presented in Table 4-25.

Table 4-25. Alternative A: Combined Economic Effects, Drilling and Production

	Total Economic Impact	Total Earnings	Employment (Direct & Indirect AJE)
Drilling & Completion	$1.762 billion	$236 Million	378 (20 years)
Production	$4.584 billion	$336 million	241 (40 years)
Total	$6.346 billion	$572 million	n/a

Source: UW 2001

Losses in total economic activity in southwest Wyoming associated with loss of forage resulting from Alternative A-related disturbance would be an estimated $692,000 over the 40-year LOP. Estimated total losses in earnings would be $126,000. An estimated annual average of 0.17 jobs would also result from the reduction in AUM's.

The estimated in-migrant population associated with Alternative A would be 400 in 2003, increasing to a peak of over 660 in 2021, falling to about 240 in 2023 (when drilling is scheduled to end), and decreasing steadily thereafter. As with the Proposed Action, this population would be distributed throughout southwest Wyoming but concentrated in Rock Springs and, to a lesser degree, Rawlins.

During the 20-year drilling cycle, an estimated monthly average of 97 workers would be working in the wellfield, with peak monthly averages occurring in August at 174 workers. Peak employment days could rise to about 290 in August if peak days on several wells occurred simultaneously. Employment levels would be increased by 12 workers for 7 days during periods when each of the anticipated six compressor stations are constructed. Similarly, employment levels would be increased by 24 workers for 21 days during periods when each of the two anticipated processing plants is constructed.

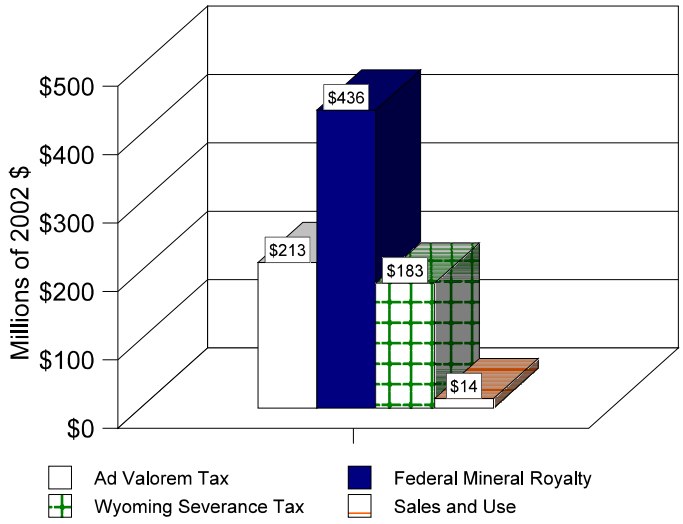
Most employees would be likely to locate in Rock Springs or Rawlins, although with the increased potential for multi-year drilling contracts in the DFPA, more workers may be induced to seek long-term residences in communities near the project area. Rock Springs and Rawlins have adequate housing resources (houses for sale and rent, apartments, mobile home pads and motels) to accommodate both long and short term housing demand associated with Alternative A. At present, Wamsutter and Baggs have little available housing and would be able to accommodate only a small portion of demand unless new housing resources are constructed. Most DFPA workers seeking short term lodging would have to travel to Rock Springs, Rawlins or Craig, Colorado.

As with the Proposed Action, most community services in Rock Springs and Rawlins have capacity to accommodate the relatively small incremental demand associated with Alternative A. Additionally, the substantial tax revenues generated by Alternative A would provide adequate funds to offset increased demand for local government facilities or services, although project-generated revenues may lag project-related demand for services.

The currently strained condition of certain public services in the Town of Wamsutter would be exacerbated if DFPA workers were to locate in the community. Neither Wamsutter nor Baggs would receive substantial revenues from oil and gas development, so they are limited in their ability to rapidly increase capacity of public facilities and services to accommodate increases in demand. Although there would be increased numbers of workers seeking housing under Alternative A, the lack of housing would prevent substantial numbers of workers from locating in these communities and increasing demand for services, at least in the near term.

Tax revenues would be increased by 50 to 55 percent under Alternative A. Figure 4-14 displays estimated tax revenues associated with this alternative. Alternative A-related tax and royalty revenues would total an estimated $846 million over the 40-year assessment period.

Figure 4-14. Total Ad Valorem Property Tax, Federal Mineral Royalty, Severance Tax and Sales and Use Tax Revenues Associated with Alternative A



Source: Blankenship Consulting LLC

The 54 percent increase in drilling, field development and production associated with Alternative A (contrasted with the Proposed Action) would amplify the effects on attitudes and opinions described in Section 4.11.3.6. As with the Proposed Action, Alternative A would receive general support in Sweetwater and Carbon counties, but certain population segments would experience an increase in negative effects. Hunters and other recreationists who use the DFPA would be more likely to feel that the hunting or recreation experience is diminished by changes in game patterns or changes in the undisturbed landscapes, isolation and solitude. Individuals and organizations who believe that public land within the MVMA should be left in its relatively undisturbed state would also be more dissatisfied under this alternative. Additionally, with the increased disturbance and wellfield activity, there is potential that an increased number of residents might feel that recreation resources and wildlife habitat would be impacted.

The potential for conflicts between grazing and drilling and field development activities would also increase, with corresponding potential for dissatisfaction among affected grazing permittees.

4.12.3.3 Alternative B - No Action

Under the No Action Alternative an unknown number of wells and ancillary facilities would be developed, including previously approved decisions for the Mulligan Draw and Dripping Rock/Cedar Breaks areas, and wells and ancillary facilities in other areas of the DFPA, which could be approved by the BLM on a case-by-case basis. Using the same assumptions as the Proposed Action and Alternative A, each well developed under the No Action Alternative would result in the following estimated economic impacts.

Short-term impacts of each well on grazing would total about $50 to $85 dollars in loss of total economic activity for each year of disturbance (depending on the location of the well), and $8 to $15 dollars in wages. Long term disturbance associated with a producing well would result in a loss

of an estimated $1,500 to $1,800 in total economic activity, and $263 to $358 in total wages over the 40-year LOP.

Table 4-26. Per Well Economic Impacts for a Dry Hole

	Drilling
Total Economic Impact	$2,118,556
Labor Earnings	$322,943
Total Jobs (AJE)	11

Note: job estimates include direct and indirect; AJE denotes annual job equivalents
Source: UW 2001

Table 4-27. Per Well Economic Impacts for a Producing Well

	Drilling	Completion	Production	Total
Total Economic Impact	$2,118,556	$1,319,634	$14,401,498	$17,839,688
Labor Earnings	$322,943	$116,925	$944,603	$1,384,471
Total Jobs (AJE)	11	4	0.68	n/a

Note: job estimates include direct and indirect; AJE denotes annual job equivalents, AJE's are not additive because they cover different periods.
Source: UW 2001

Based on the simulation presented in Section 4.12.3.1.3, DFPA employment associated with each well would average 15 workers during the first month of drilling, 19 during the second month and 11 during the third month or completion phase of a producing well. On a per well basis, population, housing and community service impacts of drilling, completion and production would be negligible, but as the level of development approaches the Proposed Action, impacts would similarly approach those described in Section 4.12.3.1.

Fiscal

Estimated total per well ad valorem, sales and use and state severance taxes and Federal Mineral Royalty revenues are displayed in Figure 4-15.

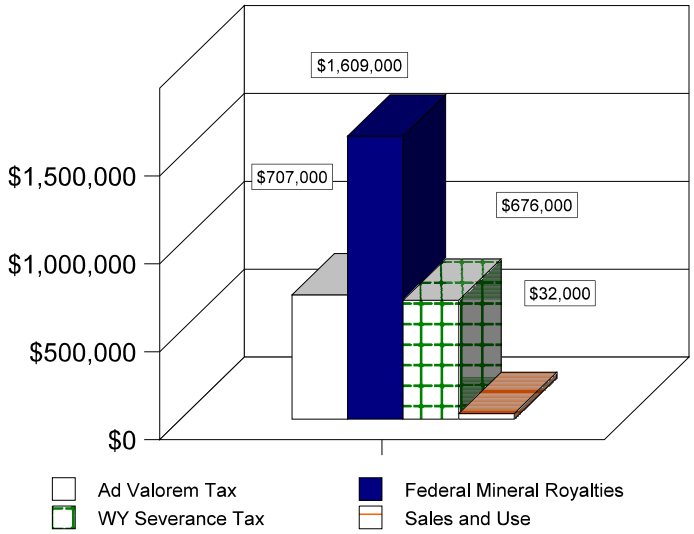
Per well tax and royalty revenues would total an estimated $3.195 million.

Attitudes and Opinions.

The No Action Alternative would result in dissatisfaction for some area residents who favor oil and gas development on public lands. Hunters and other recreationists who use the DFPA might experience negative impacts from changes in game patterns or changes in the undisturbed landscapes, isolation and solitude if wells were located in preferred hunting or recreation areas, but overall dissatisfaction could be substantially less than either action alternative, depending on the number of wells ultimately approved. Levels of dissatisfaction among individuals and organizations

who believe that public land within the MVMA should be left in its relatively undisturbed state would be dependent on whether or not wells were located within that area. The potential for conflicts with grazing activities would be reduced under this alternative, unless the ultimate number of wells drilled approached that of the Proposed Action.

Figure 4-15. Estimated Per Well Ad Valorem, Sales and Use, State Severance and Federal Mineral Royalty Revenues Per Well



Source: Blankenship Consulting LLC

4.12.4 Impacts Summary

Economic impacts of natural gas development and production would be largely positive under any of the three alternatives in this assessment.. Based on the assumptions used for this assessment, natural gas development would enhance regional economic conditions and generate substantial local, state and federal tax and royalty revenues. Economic benefits would be 50 to 55 percent higher under Alternative A than the Proposed Action. Total economic benefits for Alternative B cannot be estimated

Natural gas-related economic benefits may be diminished slightly by reductions in grazing, hunting and other recreation activity in the project area. However, recreation use of the DFPA is believed to be light, and some displaced recreation users may recreate elsewhere within the two-county region, resulting in minimal net loss to the regional recreation economy. The loss of grazing and recreation income would be greater under Alternative A than the Proposed Action.

For all alternatives, the relatively small population increment associated with drilling and field development would be disbursed throughout southwest Wyoming and accommodated in large part by existing housing and community services. Smaller communities such as Wamsutter and Baggs would not be able to accommodate substantial growth without additional housing and improvements

to community infrastructure. Project-related sales and use tax and property tax revenues would offset project-related demand for local government services in counties and larger communities, although revenues may lag demand in the early years of the project, depending on the pace of development. Smaller communities such as Wamsutter and Baggs would receive minimal direct tax revenues from natural gas development, limiting their ability to expand community infrastructure to accommodate project-related demand. Because of the limited housing resources in these communities, substantial project-related growth is not anticipated in the near-term.

Community acceptance of natural gas development would be mixed. Many residents would support the development, but those individuals, groups and organizations who feel that recreational resources and undisturbed landscapes would be negatively impacted by development on public land would be dissatisfied. The level of dissatisfaction would be correlated with the level and pace of development, therefore alternatives that resulted in higher levels of drilling and field development would generate higher levels of dissatisfaction among these individuals, groups and organizations.

4.12.5 Additional Mitigation Measures

No mitigation measures beyond those outlined in Section 2.5.2.11.2 are proposed.

4.12.6 Residual Impacts

Even after implementation of the mitigation measures outlined in Section 2.5.2.11.2, it is likely that dissatisfaction would remain among some hunters, recreationists and individuals and organizations who believe that public land within the MVMA and adjacent areas should be left in its relatively undisturbed state.

4.12.7 Environmental Justice

Neither the Proposed Action nor the other alternatives would directly effect the social, cultural, or economic well-being and health of minorities or low income groups. The DFPA is relatively distant from population centers, so no populations would be subjected to physical impacts from the Proposed Action or alternatives. Low income groups may indirectly benefit from the increased economic activity and secondary job opportunities resulting from all three alternatives.

4.13 TRANSPORTATION

4.13.1 Introduction

This section identifies potential effects of the Proposed Action and alternatives on the transportation system providing access to the DFPA (federal and state highways and county roads) and the road network within the DFPA (primarily BLM roads and a few roads accessing private lands). Potential effects of new and improved roads within the DFPA on soils, wildlife habitat, visual resources and range resources are described within those sections of the assessment.

4.13.2 Impact Significance Criteria

The following criteria are used to determine whether transportation impacts of the Proposed Action would be significant:

- Increases in traffic levels on the local public highway network that would cause the level of service on large segments of those public highways to fall below acceptable levels as defined by the responsible government agency.

- Measurable increases in accident rates on the local public highway network above the average accident rate for similar roadways which would increase the risk to highway users.

4.13.3 Direct and Indirect Impacts

4.13.3.1 Proposed Action

Federal and State Highways

The Proposed Action would generate increases in traffic volumes on highways and roads providing access to the project area. These increases would result from the movement of project-related workers, equipment and materials to and from the project area to perform drilling, field development, well service, field operations and reclamation activities.

Table 2-1 in Chapter 2 shows the estimated average number of trips associated with various well field activities. Drill rigs and certain other items of heavy equipment would be transported to the DFPA and remain onsite until their relevant work is completed. Materials and supplies would be delivered on an as-needed basis. Drilling and completion crews would commute to the DFPA daily. Other contractors and vendors would commute on an intermittent, as-needed basis.

Based on a simulation of drilling activities for a typical well and the timing of each of the annual average 19 wells which would be drilled within a calendar year, the Proposed Action would generate an estimated average of 32 trips per day. During summer months this average would average between 75 and 90 trips per day, during April and May there would be virtually no trips. Peak daily traffic could be substantially higher, particularly on days when rigs are moved into or out of the area or intensive completion activities occur. During operations, daily traffic would be reduced to an average of under 20 trips per day with higher peak days during workovers and other maintenance activities occurring on an intermittent basis.

Proposed Action-related average daily traffic would total less than one percent of 2000 ADT on I-80, and about 2 to 3 percent of 2000 ADT on WYO 789. In summer, Proposed Action-related traffic would approach 4 to 6 percent of 2000 ADT.

Based on the assumptions and estimates used for this assessment, the increase in area traffic associated with the Proposed Action would not result in a significant deterioration of level of service for I-80 or WY 789 (Rounds 2000).

Given the relatively small increment of traffic associated with drilling and field development, it is unlikely that the Proposed Action would result in a measurable increase in accident rates on I-80 or WY 789; during the operations phase, the probability of an increase in accident rates attributable to the Proposed Action would be negligible.

CO 13 may receive a minimal amount of project-related traffic increases on an intermittent basis if some DFPA workers seek temporary lodging in Craig. The anticipated low volume of traffic would not result in significant impacts to the highway or to highway safety.

County Roads

The Proposed Action would result in increases in traffic on the county roads that provide access to the DFPA, primarily SCR 23/CCR 701, the Wamsutter/Dad Road. CCR 700 provides access to the southeastern corner of the DFPA and is likely to receive substantially less use than the Wamsutter/Dad Road.

The Proposed Action would increase the already substantial amount of oil and gas-related traffic on the Wamsutter/Dad Road. Current impacts to this road, which has been reconstructed and maintained for oil and gas traffic, are more related to the speed of the traffic and use of the road during muddy conditions than traffic volume (Vanvalkenburg 2000, Nations 2000). The traffic associated with the Proposed Action would contribute to the already substantial maintenance requirements on the road. Incremental maintenance costs would be offset by the revenues generated to the counties by the Proposed Action (Section 4.12.3.1.6). However, in the initial years of the project, counties could be required to provide road maintenance without corresponding increases in project-related revenues if maintenance requirements occur before substantial production-related revenues began to accrue to the counties.

Internal Roads

There are no federal or state highways or county roads within the DFPA. Roads within the DFPA have been developed incrementally to serve oil and gas exploration, development and production activities and to provide access for grazing activities. Some casual roads and two tracks have developed over time to provide access for hunting and other recreational visitors. The existing transportation network within the DFPA (an estimated 661 miles of existing roads and two-track roads) is generally suitable for existing uses. Where possible, existing roads would be used to access wellfield facilities, but new roads would also be required, and certain roads would need to be upgraded to serve development and production needs associated with the Proposed Action. Based on the estimated average of 1.5 miles of road per well, a total of 542 miles of new or upgraded roads would be required. The Operators would be responsible for constructing and maintaining new and improved roads within the DFPA, and for maintaining existing roads. Section 2.5.2.1 (Access Road Construction) describes the measures proposed by the Operators to develop the transportation network necessary to access wells and ancillary facilities within the DFPA. Standards for road design and construction would be consistent with BLM Road Standards Manual Section 9113. DFPA operators would also establish maintenance agreements with designated responsibilities for maintaining all roads; existing, improved and newly constructed.

The increased traffic associated with drilling and field development (an average annual of 32 trips per day with possible daily peaks substantially higher) would accelerate maintenance requirements on existing, upgraded and new roads, particularly if roads are used during wet or muddy conditions. Damaged roads would primarily affect the activities of DFPA operators, although grazing operators and recreationists may also be temporarily affected. Based on the Operators' commitment to construct and maintain roads, Proposed Action-related impacts on the transportation network within the DFPA would not be significant.

New road construction or upgrading of existing roads on private lands would conform to land owner standards. These standards may differ form BLM standards.

The increased traffic in the DFPA, particularly during the drilling and field development phase, would correspondingly increase the potential for vehicle/livestock accidents during that period. These potential impacts are discussed in Section 4.6.

Portions of the DFPA are located in areas that contain sensitive resources (e.g., cultural, soils, wildlife habitat and visual resources). Construction of new roads or improvement of existing roads in these areas have the potential to impact those sensitive resources, although BLM road standards, RMP stipulations, operator proposed mitigation measures and the preconstruction planning and site layout process described in Section 2.5.1 would minimize these impacts.

4.13.3.2 Alternative A

Alternative A would involve a 54 percent increase in well locations over the Proposed Action, therefore traffic impacts on federal and state highways and county roads would correspondingly be over 50 percent higher, although some economies of scale would occur if individual operators were to drill more than one well at a time. Under the assumptions used for this assessment, average daily traffic to the DFPA would be about 52 trips, with average daily traffic during summer months substantially higher. Peak day traffic would also be substantially greater, especially if rig moves or initiation of completion activities on several wells were to coincide. This increase in traffic would still be within tolerable service levels for federal and state highways that provide access to the DFPA. Alternative A-related increases in traffic would accelerate maintenance requirements on the Wamsutter/Dad Road, but would also provide corresponding increases in county tax revenues to offset maintenance costs. As with the Proposed Action, project-related tax revenues may lag project maintenance demand during the initial years of drilling and field development.

Implementation of Alternative A would require construction of an estimated 833 miles of new or upgraded roads within the DFPA. As with the Proposed Action, implementation of Operator commitments and BLM requirements for the construction and maintenance of roads would avoid significant impacts to the transportation network within the DFPA. Opportunities for vehicle/livestock accidents would be increased under Alternative A.

4.13.3.3 Alternative B - No Action

Under Alternative B, wells and ancillary facilities associated with the previously approved Mulligan Draw and Dripping Rock/Cedar Breaks areas and an unknown number of wells and ancillary facilities could be approved by the BLM on a case-by-case basis in other portions of the DFPA. Drilling and field development activity under the No Action Alternative could be substantial, but would occur without a coordinated transportation plan. Average daily traffic for each well developed under the No Action Alternative would be about 7 to 9 trips per day over a 2 to 3 month period, with substantially higher peak days during rig moves and completion activities. An estimated average of 1.5 miles of new or upgraded access road within the DFPA would be required for each well. Transportation impacts associated with the No Action Alternative would be dependent on the number of wells drilled and the pace of drilling and field development.

4.13.4 Impacts Summary

Transportation effects of natural gas development and production would include increased traffic on federal and state highways and county roads providing access to the DFPA, including US I-80, WYO 789, CO 13, SCR 23/CCR 701 (the Wamsutter/Dad Road), and CCR 700. There would also be a statistical increase in the potential for accidents on these roads. Given the small increase in traffic associated wit the development relative to existing traffic on these highways and roads, transportation impacts are not anticipated to be significant under any of the three alternatives considered for this assessment.

Transportation effects within the DFPA would occur on BLM and operator-maintained roads. Operators would be required to construct new roads and improve existing roads to BLM standards, except in cases where roads cross private surface. Operators would also be required to maintain new and existing roads accessing natural gas facilities within the DFPA. Based on these factors and the implementation of the coordinated transportation planning process described in Section 4.13.5, significant impacts to transportation systems within the DFPA are not anticipated for any alternative.

4.13.5 Additional Mitigation Measures

In addition to the Operator-committed measures and BLM-required procedures, outlined in Sections 2.5.2.1 and 2.5.2.11.2, a coordinated transportation plan (TP) should be developed for the DFPA. The coordinated transportation process could include the BLM, the Operators, private landowners, livestock operators, county road superintendents, recreation and environmental interest groups, and other interested parties.

4.13.6 Residual Impacts

A TP would minimize construction of new roads, foster proper sizing of roads and assign road maintenance responsibilities. The initial transportation planning effort would identify the most efficient and resource-sensitive locations for collector and local roads (existing roads should be used as collectors and local roads whenever possible to minimize the amount of surface disturbance within the area). However, because the locations of new wells and ancillary facilities are not currently known, transportation planning would continue to occur on an annual basis to: (1) identify the minimum road network necessary to support annual drilling and field development activities; (2) review and assign construction and maintenance responsibilities of the Operators; (3) identify roads appropriate for abandonment and reclamation; and (4) identify fences, gates and cattle guards which should be upgraded to accommodate heavy trucks and equipment.

Operator responsibilities for preventive and corrective maintenance of roads in the DFPA would extend throughout the duration of the project and include blading, cleaning ditches and drainage facilities, dust abatement, control of invasive, non-native species, maintenance of fences, gates and cattle guards and other requirements as directed by the BLM.

4.14 HEALTH AND SAFETY

4.14.1 Introduction

Potential health and safety impacts associated with the Proposed Action and alternatives are similar to those associated with existing conditions in the DFPA, although the risk of certain types of impacts would increase as the amount of natural gas development increases. Potential health and safety impacts include occupational hazards associated with oil and gas exploration and operations, risk associated with vehicular travel on improved and unimproved BLM roads, firearms accidents during hunting season and range fires.

4.14.2 Impact Significance Criteria

No specific health and safety standards were identified in the GRRA or GDRA RMPs. In general, health and safety effects of the Proposed Action would be considered significant if they resulted in substantially increased risk to the public.

4.14.3 Direct and Indirect Impacts

4.14.3.1 Proposed Action

4.14.3.1.1 Occupational Hazards

Two types of workers would be employed in the DFPA: oil and gas workers, who had a1999 accident rate of 3.3 per 100 full-time workers, and special trade contractors, who had a non-fatal accident rate of 8.8 per 100 workers (U.S. Department of Labor, Bureau of Labor Statistics 2000). These rates compare with an overall private industry average for all occupations of 6.2 accidents per 100 workers. During the 20 -year drilling and field development phase of the project when an annual average of 61 drilling and field development workers and 10 to 20 operations workers would be performing work in the DFPA, it is statistically probable that about 8 injuries (loss time and non-loss time) would occur each year. Anticipated accidents would be slightly higher during years when compressor stations and the gas processing plant would be under construction. Once drilling and field development are completed, the annual statistical probability of injuries would be less than one, given the relatively low level of employment in the DFPA (less than 20 workers).

The US BLM, OSHA, USDOT and Wyoming OGCC each regulate particular safety aspects of oil and gas development. Adherence to relevant safety regulations on the part of the Operators and enforcement by the respective agencies would reduce the probability of accidents. Additionally, given the remote nature of the project area, and the relatively low use of these lands (primarily grazing permittees and a small number of hunters and other recreationists.), occupational hazards associated with the Proposed Action would mainly be limited to employees and contractors rather than the public at large.

4.14.3.1.2 Pipeline Hazards

Increasing the miles of gathering line within the analysis area would increase the chance of a pipeline failure. Accidents rates for gas transmission pipelines are historically low. Nationwide, injuries associated with gas transmission pipelines averaged 14 per year from 1990 through 1996, fatalities averaged one per year and incidents such as ruptures averaged 79 per year (U.S. Department of Transportation 1998). Therefore, the relatively small amount of new pipeline associated with the Proposed Action (an estimated 350 miles), coupled with the low probability of

failure and the remoteness of the project area would result in minimal risk to public health and safety. Signing of pipeline ROW's could reduce the likelihood of pipeline ruptures caused by excavation equipment--particularly in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities.

4.14.3.1.3 Hazardous Materials

Drilling, filed development and production activities require use of a variety of chemicals and other materials, some of which would be classified as hazardous (see Appendix D: Hazardous Substance Management Plan). Potential impacts associated with hazardous materials include human contact, inhalation or ingestion and the effects of exposure, spills or accidental fires on soils, surface and ground water resources and wildlife.

The risk of human contact would be limited predominately to DFPA operator and contractor employees. The Hazardous Substance Management Plan, Hazard Communication Program, Spill Prevention Control and Countermeasure (SPCC) Plans, and other mitigation measures described in Section 2.2.2.11 would reduce the risk of human contact, spills and accidental fires, and provide protocols and employee training to deal with these events should they occur. Based on successful implementation of the above-listed plans and procedures, no significant impacts associated with hazardous materials would be anticipated.

4.14.3.1.4 Other Risks and Hazards

Highway safety impacts are discussed in Section 4.12 (Transportation). Sanitation and solid waste impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Section 2.2.2.11.2.

The potential for firearms-related accidents would occur primarily during hunting season. The substantial activity in portions of the project area during drilling and field development would encourage hunters to seek more isolated areas thus reducing the potential for accidents. During operations, the relatively few personnel on site would result in minimal risk of firearms-related accidents.

The risk of fire in the analysis area would increase under the Proposed Action. This is an unavoidable impact associated with construction activities, industrial development and the presence of fuels, storage tanks, natural gas pipelines and gas production equipment. However, this risk would be reduced by the placement of facilities on pads and locations that are graded and devoid of vegetation which could lead to wildfires. In the event of a fire, property damage would be limited to construction or production related equipment and range resources. Fire suppression equipment, a no smoking policy, shutdown devices and other safety measures typically incorporated into gas drilling and production activities would help to minimize the risk of fire. There would be a heightened risk of wildfire where construction activities place welding and other equipment in close proximity to native vegetation. Given the limited public use and presence in the project area, the risk to the public would be minimal. There would be a small in increase in risk to area fire suppression personal associated with the Proposed Action.

Based on the foregoing assessment, risks to public health and safety should not significantly increase as a result of the Proposed Action.

4.14.3.2 Alternative A

Under Alternative A, the number of wells drilled would be increased by about 54 percent. An annual average of about 10 occupational accidents would be anticipated during drilling and field development and less than one after drilling has been completed. The increase in other types of accidents would also be increased because of the higher level of activity within the DFPA during drilling and field development. Given the remoteness and isolation of the DFPA, the health and safety impacts to the general public would not be significant.

4.14.3.3 Alternative B - No Action

Under the No Action Alternative, health and safety risks would continue at levels previously authorized for Mulligan Draw and Dripping Rock, and be associated with natural hazards, grazing and recreation activities, and natural gas development approved on a case-by-case basis.

4.14.4 Impacts Summary

Hazards associated with the drilling program, including construction and operation, are those normally associated with heavy construction and industrial work. There would be a minor increased risk to the public caused by project implementation resulting from additional drilling and production related traffic in the DFPA. None of these impacts occur at significant levels.

4.14.5 Additional Mitigation Measures

The mitigation measures described in Section 2.2.5.11.2 should be sufficient to mitigate risks to public health and safety.

4.14.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.14.3.

4.15 NOISE

4.15.1 Introduction

Noise associated with the Proposed Action and alternatives would be caused by machinery used during drilling and construction of pipelines and access roads, construction and operation of ancillary facilities, and by heavy trucks and related equipment.

4.15.2 Impact Significance Criteria

The following criteria was used to assess the significance of noise impacts related to this project:

C Long-term activities that would exceed federal 55 dBA maximum standards for noise at either human or animal sensitive locations.

4.15.3 Direct and Indirect Impacts

Overall, noise produced by drilling, field development and operations would be moderate because of the dispersed and short-term nature of these activities. Given the remoteness and isolation of the DFPA, drilling, field development and operations activities associated with drilling, field development and production operations would not affect noise sensitive locations for humans. Other users of the DFPA would be affected infrequently for periods of short duration as they move through the area. Affects on noise sensitive locations for animals would be avoided by implementation of the preconstruction planning and design measures described in Chapter 2.

4.15.3.1 Proposed Action

Noise associated with drilling, field development and production could potentially affect human comfort and safety (at extreme levels) and modify animal behavior. Noise levels in excess of the 55 dBA maximum standards can occur during construction and maintenance of well sites, access roads, ancillary facilities such as compressor sites and pipelines. However, perception of sound varies with intensity and pitch of the source, air density, humidity, wind direction, screening/focusing by topography or vegetation, and distance to the observer. Under typical conditions, excess levels decline below the level of significance (55 dBA) at 3,500 feet from the source. Drilling and field development-related noise impacts would be short-term, occurring on an intermittent basis at different locations throughout the DFPA throughout the estimated 20-year drilling and field development cycle. Substantially lower and less frequent noise disturbances would occur throughout the productive life of the field.

Noise sensitive locations include areas that are routinely occupied or frequented by humans or animals. In general, it has been found that mammals and birds will consistently escape from noises that exceed 75-85 dBA. Below that level, noise sensitivity would vary by species.

Human sensitivity to noise would depend, in part, upon proximity to the noise source, background noise levels, physiology, frequency and the intended activity. For example, non-motorized recreation users may be more sensitive to noise impacts than most other resource users. However, current recreation use of the DFPA is believed to be low.

Studies have found that big game move away from frequently traveled roads. A study of the Birch Creek area of the BLM RSFO found that displacement of big game animals away from drilling rigs occurs but that animals quickly return to the area once drilling has been completed--despite some increase in maintenance-related traffic (Reeve 1995). Sage grouse are also known to be affected by high levels of noise (see Section 4.7.4.1.4).

The preconstruction planning and design measures discussed in Section 2.5.1 would avoid locating well sites and ancillary facilities in noise sensitive areas for animals. Given the remoteness and isolation of the DFPA, no noise sensitive locations for humans (such as residences or places of business) would be affected. Grazing operators and recreationists using the DFPA may temporarily be affected by noise disturbances as they move through a construction or drilling area, however, such contacts are anticipated to be infrequent and short in duration. Drilling, construction and

operations workers would be subject to federal and state health and safety standards for sound protection. Given these circumstances, and assuming successful implementation of the mitigation measures proposed in Chapter 2 and Section 4.14.5, noise impacts associated with the Proposed Action would not be significant.

Noise impacts could occur within the Adobe Town WSA if wells, ancillary facilities or roads were located near the WSA boundary. Depending on the location of the activity relative to the WSA boundary, the nature of the activity and the terrain between the activity and the WSA boundary, WSA users could hear natural gas activities, particularly during the drilling and field development stages of the project. These impacts would diminish substantially during project operations, and be limited primarily to vehicular traffic and occasional well maintenance activities. The magnitude of noise impacts within the WSA would depend on the number and type of facilities located near the boundary, the time of year, and actual use of the portions of the WSA near natural gas activities.

4.15.3.2 Alternative A

The implementation of Alternative A would increase the number of wells drilled over the Proposed Action by about 55 percent. While the noise levels at individual drill sites and ancillary facilities would be similar to those associated with the Proposed Action, noise-generating activities would occur more frequently at more locations within the DFPA. The location of no more than four wells per section and the short-duration of drilling and field development activities would minimize cumulative noise impacts within the DFPA. Noise levels associated with drilling, field development and construction traffic would also be greater under this alternative as would opportunities for impacts on noise sensitive locations for animals. However, properly implemented preconstruction planning and design measures would avoid such impacts.

Given the increased densities of well pads associated with Alternative A, it is possible that more wells, roads and ancillary facilities would be located adjacent Adobe Town WSA boundaries, if substantial natural gas reserves are found in that area. Consequentially, the potential for noise impacts to human users of the WSA would be increased under this alternative.

4.15.3.3 Alternative B - No Action

Implementation of Alternative B would result in noise producing activities similar to those described for the Proposed Action and Alternative A. The total amount, frequency and duration of noise producing activities would depend on the level of development that would actually occur in the DFPA under the No Action Alternative. Development under Alternative B could include the 57 wells and ancillary facilities already approved for the Mulligan Draw and Dripping Rock/Cedar Breaks areas and additional wells and ancillary facilities approved by the BLM on a case-by-case basis in other portions of the DFPA.

Under the No Action Alternative, 23 wells could be developed in the Mulligan Draw area, which borders the Adobe Town WSA. Additionally, wells approved in the southwestern portion of the DFPA on a case-by-case basis could border the WSA. Noise impacts to human users of the WSA would depend on the number of wells, ancillary facilities and roads developed adjacent to the WSA boundary, terrain, time of year, and the number of users of the portion of the WSA adjacent to natural gas development.

4.15.4 Impacts Summary

Given the size and remote nature of the DFPA, the low human population densities in surrounding areas and the operator committed mitigation measures, significant noise impacts on human populations are not anticipated under any alternative. Although noise impacts would occur more frequently at more locations under Alternative A than under the Proposed Action or Alternative B, project workers would be the principally affected population, and they would be protected by OSHA and other health and safety regulations. Grazing operators and recreationists using the DFPA are likely to experience noise impacts for brief periods when passing through areas where drilling, construction or maintenance activities are underway. Noise impacts would be greatest during the drilling and field development phase of the project. During project operations, noise impacts would be substantially reduced.

The preconstruction planning and design measures discussed in Section 2.5.1 would prevent the location of well sites and ancillary facilities in noise sensitive areas for animals under all alternatives.

Depending on the location of wells, ancillary facilities and roads in areas adjacent the Adobe Town WSA boundary, users of the WSA could be impacted by noise, principally from drilling and field development activities. During the operations phases of the project, noise impacts on users of affected portions of the WSA would be minimal.

4.15.5 Additional Mitigation Measures

No mitigation measures are proposed beyond those described in Section 2.5.2.11.2.

4.15.6 Residual Impacts

Given the application of the mitigation measures outlined in Section 2.5.2.11.2 and considering that no additional mitigation measures are proposed, no residual impact discussion is required. Impacts would remain the same as described in Section 4.15.3.